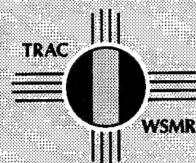

TRAC-WSMR-TR-97-015

Distance Learning Annotated Bibliography



Fay S. Howard

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DEPARTMENT OF THE ARMY
June 1997

Final Report

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Distance Learning Annotated Bibliography

Fay S. Howard

Final Report

DEPARTMENT OF THE ARMY

TRADOC Analysis Center-White Sands Missile Range (TRAC-WSMR)
White Sands Missile Range, NM 88002-5502

June 1997

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REPORT DOCUMENTATION PAGE

**Form Approved
OMB No. 0704-0188**

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)			2. REPORT DATE June 1997		3. REPORT TYPE AND DATES COVERED Final; February 1996 - May 1996	
4. TITLE AND SUBTITLE Distance Learning Annotated Bibliography			5. FUNDING NUMBERS			
6. AUTHOR(S) Howard, Fay S.						
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) TRADOC Analysis Center-White Sands Missile Range (TRAC-WSMR) ATTN: ATRC-WG White Sands Missile Range, NM 88002-5502			8. PERFORMING ORGANIZATION REPORT NUMBER TRAC-WSMR-TR-97-015			
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) ATTN: ATTG TRADOC Deputy Chief of Staff for Training Fort Monroe, VA 23651-5000			10. SPONSORING/MONITORING AGENCY REPORT NUMBER			
11. SUPPLEMENTARY NOTES						
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE			
13. ABSTRACT (Maximum 200 words) <p>This study was conducted for the TRADOC Deputy Chief of Staff for Training. This report reviews relevant studies and articles on distance learning (DL) to support the implementers of the DL plan. The annotated bibliography contains summaries of 106 articles from military, industry, and universities. The main report divides the 106 articles into ten categories. The categories were selected based on interest expressed from the proponent and commonalities of the literature. The categories are evaluations of DL; guidelines for planning and implementing DL; computer-based training, computer-aided training, and computer-mediated communication; video teletraining, videotapes, and interactive videodisk; professional education; student interaction with instructors, other students, and technology; reviews of DL literature; descriptions of some specific DL programs; cost effectiveness and system costs; and miscellaneous. These principal results were summarized from the articles. All forms of DL are at least as effective as traditional instruction in most instances. Course development for DL could be costly but the number of people trained could recoup the costs quickly. Instructors for DL would at least initially need training in interaction skills, summary techniques, oral communication skills, and DL equipment operation. Costs for both the technology and course conversions were high but higher enrollments over a period of time would offset the costs.</p>						
14. SUBJECT TERMS distance learning, video teletraining, computer-based instruction, computer-mediated communication, computer-aided instruction, distance education, interactive videodiscs; interaction; system costs; cost effectiveness, evaluation.				15. NUMBER OF PAGES		
16. PRICE CODE						
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT U			

Distance Learning Annotated Bibliography

Executive Summary

The reason for performing this study was to consolidate available empirical evidence on distance learning (DL) into a practical user's reference. The Training and Doctrine Command (TRADOC) has developed a plan to implement DL for Army training. A review of current relevant work in DL was needed for the personnel responsible for implementing the plan.

The main assumption for this study was that the most pertinent articles would be readily retrieved from the available sources.

This project included a review and descriptive summary of relevant work completed and in-progress in DL in the military, in industry, and universities. The review focused on adult education and reports published from 1990 to 1996.

The study objective was to consolidate available empirical evidence on distance learning into a practical user's reference.

This review was done by searching Educational Resources Information Center (ERIC), Defense Technical Information Center (DTIC), PsychLit, the Internet, as well as attending selected professional conferences and meetings on DL. A total of 300 documents were initially identified from searches applying the criteria above. Of these, 106 were determined applicable to this study based on subject matter, method of evaluation, and source of the document. These 106 articles and books were divided into ten categories based on interest expressed from the study proponent and the commonalities of the literature.

All forms of DL are at least as effective as traditional instruction in most instances. In the studies reviewed, a wide variety of topics and time periods successfully used DL media. DL is also effective for a variety of class types to include: seminars, group instruction, individual training, hands-on, and laboratory. Course development for DL could be costly but the number of people trained could recoup the costs quickly. Courses that were up to date and organized were cheaper to convert than out of date courses. The issue of reconfiguring of materials would merit additional research. Fully developed standards and guidelines for the course converter could result in lower costs. Instructors for DL would at least initially need training in interaction skills, summary techniques, oral communication skills, and DL equipment operation. Video teletraining (VTT) instructors would also need training in VTT techniques. Interaction between the students and the student-instructor were a concern in many DL studies. These interactions could be improved with bulletin boards and e-mail. Direct student-instructor contact improved student perception of the course and increased the completion rate. Costs for both the technology and course conversions were high but higher enrollments over a period of time would offset the costs. A careful match of the training needs and technology available could result in cost savings. Although DL had

a higher attrition rate than traditional instruction, the studies reviewed suggest the motivation of the student and personal factors were the cause more than an effect of the technology.

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Distance Learning Annotated Bibliography Summary

Purpose

The purpose of this project is to consolidate available empirical evidence on distance learning (DL) into a practical user's reference. The project was conducted by the Training Analysis Directorate of the Training and Doctrine Command (TRADOC) Analysis Center-White Sands Missile Range (TRAC-WSMR) for the TRADOC Deputy Chief of Staff for Training (DCST).

Background

DL has had many names including distance education and distributed training. DL in this study is defined as instruction delivered to the student through medium that takes the instructor to the student. This normally occurs at a remote learning site, the work place, or even at home. The primary defining characteristic is the student does not have to go to where the instructor is physically located.

DL is a rapidly developing area in both the military and the private sector. There is a wide range of technologies available for DL. Application of these technologies also varies greatly with little interaction between the different institutions employing them.

Scope

This project includes a review and descriptive summary of relevant work completed and in-progress in DL in the military, in industry, and universities. The review focuses on adult education and reports published from 1990 to 1996.

Assumption

The assumption for this study was that the most pertinent articles would be readily retrieved from the available sources.

Methodology

This review was done by searching Educational Resources Information Center (ERIC), Defense Technical Information Center (DTIC), PsychLit, and the Internet, as well as attending selected professional conferences and meetings on DL. The databases used contained articles on DL from different perspectives:

- ERIC - Educational journals, books, and sources from an educational viewpoint
- DTIC - Reports and articles from Department of Defense agencies
- Psychlit - Psychological journals, books, and sources from the psychological viewpoint

While a few books were reviewed, the main focus was journal articles and conference papers.

A total of 300 documents were initially identified from searches applying the criteria above. Of these, 106 were determined applicable to this study based on subject matter, method of evaluation, and source of the document. These 106 articles and books were divided into 10 categories. These categories were selected based on interest expressed from the study proponent and the commonalities of the literature. Some references were included in more than one section. The 10 sections include numeric references to the annotated bibliography. The 10 sections are:

- Evaluations of DL
- Guidelines for planning and implementing DL
- Computer-based training (CBT), computer-aided training (CAT), and computer-mediated communication (CMC)
- Video teletraining (VTT), videotapes, and interactive videodisk
- Professional education
- Student interaction with instructors, other students, and technology
- Reviews of DL literature
- Descriptions of some specific DL programs
- Cost effectiveness and system costs
- Miscellaneous

Literature Search

A cross-reference of topics to the bibliography is presented in table 1. A summary of the literature for each topic follows. The summaries report the information from the literature. Following the summaries of each topic is a section on the choices of delivery systems and some suggestions for use based on the literature.

Table 1. Literature References

Topic	Bibliography Number
Evaluation of DL	1, 2, 3, 4, 7, 8, 9, 10, 12, 14, 16, 17, 18, 22, 25, 27, 31, 36, 37, 38, 44, 46, 47, 48, 49, 50, 52, 54, 55, 56, 57, 58, 61, 62, 63, 65, 66, 67, 70, 71, 76, 81, 82, 83, 87, 88, 89, 92, 93, 95, 96, 97, 99, 100, 102, 105, 106
Guidelines for planning and implementing DL	6, 13, 19, 21, 28, 30, 32, 35, 41
CBT, CAT, and CMC	9, 16, 25, 32, 44, 46, 47, 49, 55, 56, 65, 71, 76, 80, 83, 87, 91, 94, 99, 102
VTT, video tapes, and interactive videodisk	4, 10, 11, 19, 27, 33, 35, 36, 37, 48, 50, 51, 52, 53, 54, 57, 58, 61, 62, 63, 64, 65, 66, 67, 74, 75, 88, 89, 92, 93, 95, 97, 100, 105, 106
Professional education	42, 72, 78, 89, 90, 93, 100
Student interaction with instructors, other students, and technology	3, 15, 16, 17, 25, 34, 38, 44, 45, 51, 54, 63, 69, 74, 79, 97
Reviews of DL literature	2, 15, 68, 70, 79, 84, 86
Descriptions of some specific DL programs	5, 8, 11, 13, 20, 33, 73, 77, 91, 101, 103
Cost effectiveness and system costs	10, 24, 30, 36, 47, 48, 49, 51, 53, 55, 59, 63, 65, 72, 75, 76, 80, 94
Miscellaneous	23, 26, 29, 39, 40, 43, 60, 85, 98, 104

Evaluations of DL

The 57 articles in this section deal with results of evaluation studies, ways to conduct effective evaluation, and characteristics of successful distance learners. Some of the evaluation studies contain both qualitative and quantitative results and others contained only one of the two. All but 1 of the 57 studies provide evidence of the effectiveness of DL. In addition to the studies that report the results of one evaluation study, there are several meta-analyses in this section (36, 55, 56). The results of the meta-analyses support DL media and will be discussed in depth in this section. The length of time that training was conducted ranged from 1 hour to 4 years, with 19 studies being 1 semester long. A wide range of subjects are covered in these evaluation studies:

- Professional certification (1, 8, 10, 37, 50, 97)
- Professional military education (2, 57, 65, 66, 76, 88, 99, 100, 102)
- Hands-on military training (2, 48, 89)
- Military specialty training (47, 48, 49, 62, 63, 65, 71, 88, 105)
- Undergraduate university classes varying from history to engineering (27, 38, 44, 46, 50, 54, 58, 70, 83, 87, 106)
- Graduate level university classes varying from education to engineering (4, 7, 9, 16, 25, 27, 38, 54, 61, 66, 70, 93, 95)
- University laboratory class (58)

Correspondence courses were evaluated in three of the studies (1, 17, 82) and found to be an effective method of learning. Most of the other studies involved printed material in combination with some other media. Audioconferencing (AC) was effective as a DL medium in seven studies (2, 4, 7, 16, 17, 37, 70). VTT, videotapes, or interactive videodisk produced positive results when compared to traditional training in 27 studies (2, 3, 4, 10, 27, 36, 37, 48, 50, 52, 57, 58, 61, 62, 63, 65, 67, 70, 88, 89, 92, 93, 95, 97, 100, 105, 106) but negative results in 1 study (66). CBT, CAT, and CMC were as effective or better than traditional training in 19 studies (8, 9, 16, 18, 25, 36, 44, 46, 47, 49, 55, 56, 65, 71, 76, 83, 87, 99, 102). One study (81) reviewed 218 research reports, summaries, and papers from 1955 to 1995 and concluded that in the studies reviewed students learned equally well whether trained as traditional students or with all DL media. DL was conducted both in groups and individually. Group DL required the same amount of learning time as traditional training, but self-paced training produced a time savings (3, 47, 48, 55, 56, 58, 65, 106).

Fletcher (36) reviewed 47 studies done from 1959 to 1990 in a meta-analysis on the effectiveness and cost of interactive videodisk instruction. Results of the studies were compared by the measure of effect size.¹ The analysis produced the following main results:

¹ Effect size can be measured in a variety of ways. In this case, the measure of effect is the standardized mean difference. This index gives the number of standard deviation units that separate the outcome scores of the experimental and control groups. An effect size of 0.35 means that the effect of the experimental treatment was to raise the outcome scores by 0.35 standard deviations or from the 50th to the 64th percentile.

- Interactive videodisk was more effective than traditional training with an average effect size of 0.50.
- The average effect size for military training was 0.38.
- Achievement in the videodisk group was less variable and more equitably spread.

In the 13 studies that examined costs, the cost was less for interactive videodisk training than for traditional training.

Kulik and Kulik (55) performed a meta-analysis on 254 controlled evaluation studies in performance between groups using computer-based instruction (CBI) and groups using traditional training. The criteria used to select studies for this analysis were that results be quantitative and that both experimental and control groups be measured in the same way. The main results of this analysis were:

- CBI had an effect size of 0.30.
- Shorter courses (1 to 4 weeks) had a larger effect size (0.42) than courses which were over 4 weeks (0.26).
- Traditional training groups had higher completion rates in 13 of the 23 studies that compared completion rates.
- Students in the CBI course completed the course in one-third less time than those students in the traditional classroom course.
- Overall, CBI produced better or the same quality results in a shorter period of time.

Kulik (56) reviewed 12 meta-analyses of CBI and summarized the major points. These points were:

- Students generally learned more when they receive CBI.
- Students learned in less time with CBI.
- Students generally liked class more with CBI.
- Students developed more positive attitudes toward computers.
- Computers did not produce positive effects in every area where they were studied.

The area where the effect size neared zero (no benefit for CBI or traditional training) was in student attitude toward the subject matter taught. The mode of instruction did not have an effect on the attitude of the students.

Five of the articles in this section (12, 14, 22, 31, 96) discuss methods to conduct effectiveness evaluation studies. Clark (12) focused on two separate but compatible issues. One was delivery technology and the other was instructional technology. Clark maintained the research in the past had confused the two and given the credit to the media for effectiveness rather than the instructional technology. He proposed

identifying the components of the system and evaluating the components for both training and cost effectiveness.

Coldeway (14) proposed three different methods to produce more stringent evaluations. The first was triangulation, which is supporting a finding by showing independent measures that agree with it. The second was component research, where the different components are identified and the relationship between the components and the learning process is evaluated. The third was to build a model to establish the optimum mixture of the components for an effective DL program.

Dean, Biner, and Coenan (22) suggested a systems model to assess the effectiveness of distance education programs. The main elements of the model were learner variables, instructor variables, presentational elements, and course content elements. The authors suggested using objective tests and interviews as a validity check for final course grades if they were used for the index of achievement in the model.

Dwyer (31) was concerned with the evaluation of the development of the training materials. The issues of how the students perceive, assimilate, store, and retrieve information must be considered by the developer. In particular, the level of visualization (how much was actually shown and how much does the mind have to form a mental picture) should be carefully evaluated. Dwyer suggested a systematic evaluation with the use of printed or oral material by itself for the control group and several experimental groups with different levels of visualization. The effectiveness and the cost could be weighed for the optimum level.

Stubbs and Burnham (96) developed a potential effectiveness inventory (PEI) to determine a system's potential effectiveness. Nineteen professionals in the field of education ranked five critical dimensions according to their importance to an electronic distance education system. These dimensions were time/place independence, level of realism possible, communication paths available, ease of use, and speed. A system received a score based on the ratings from the dimensions. The authors pointed out that this score was meaningless unless compared to another system. The authors cautioned to select the level of the dimensions that were appropriate for the type of instruction and not to be lured by high-tech toys.

Guidelines for Planning and Implementing DL

The nine articles and books in this section contain guidelines for those who are planning and implementing a DL program. These guidelines are not for selecting media but for the planning and implementing of instruction to be delivered. These articles contain 'how-to' portions and are recommended for the novice to begin a DL program. Preplanning to ensure the success of the program is a necessity. The instructors and the personnel at the training sites must be able to use the equipment and deal with equipment failure. The training site could be on the student's home computer via the Internet, compact disc-read only memory (CD-ROM), or disk, or could be at a local facility where a group of students meet and receive instruction via video technology.

The instructor must plan ahead to make sure that the students receive all the materials needed for the course (6, 30, 35); package electronic course materials in formats readily accessible by all the students (13); and encourage active learning strategies (6, 19, 32, 35). Training the instructor in teletraining techniques was a key piece in the success of the DL program (6, 19, 28, 32, 35). The instructor must spend more preparation time for the DL classroom than the traditional classroom (19, 28).

In almost every DL situation, some of the course materials were in print. Careful design of the printed self-instructional material enhanced the effectiveness of the course. The printed material should be easy to follow using vocabulary that is appropriate for the audience. When used alone, activities should be designed to help the reader assimilate the new ideas. When used in conjunction with other technology, the materials should be presented in a manner that allows the student to readily identify the relevance of the printed material (21). The same careful attention must be paid to the design of the multimedia instructional materials. The developer had to ensure that the message was not lost in the entertainment, while at the same time maintaining the interest of the student (41).

CBT, CAT, and CMC

The 20 articles and studies in this section deal with CBT, computer-aided training, and computer-mediated communication. *CBT* is defined as computer training that stands alone. *CAT* uses automation as part of the instruction. *CMC* is defined as computer to computer interaction using either e-mail, listserv, or electronic bulletin boards for discussion of instruction delivered by video, audio, print, or CBI.

Results of 16 studies (9, 16, 25, 44, 46, 47, 49, 65, 71, 76, 80, 83, 87, 91, 99, 102) and 2 meta-analyses (55, 56) all agree that computer training is just as effective, if not more so, than traditional training. The courses ranged in duration from less than 1 week to a full semester. There was a greater difference between the scores of the computer-trained students and the traditional students for shorter courses (defined as 4 weeks or less) with the computer-trained students doing better.

CBT allowed the student the freedom to work on a course when and where it was most convenient. Average time to complete courses was shorter than the time for traditional courses (47, 55, 56, 65). The addition of e-mail or some form of computer-conferencing gave the students access to the instructors or other students when needed, and improved perceptions of the classes (16, 25, 44, 46, 83). Computer-conferencing was seen as a very democratic setting without the physical attributes of the students influencing the discussions (16, 25, 44, 83). The use of specific methods to structure discussion (such as group reports, assigned debates, or study critiques) and keep it on track enhanced computer-conferencing (32).

Prior computer experience had no effect on student performance and CBT improved student views of computers (25, 47, 56). The effect of student ability is not clear at this time. In one study (46) higher ability students were reported as more likely to receive high grades and give a favorable report on the experience. In another study (80) where

the students received alternating treatments in the design, the lower achieving students had the greatest differences in performance scores with computer training being higher. The other studies did not discuss the ability level of the students.

Besides the time saving for the actual completion of the course (with the associated cost savings), several other cost issues were addressed. Standardization of equipment and development of course materials for commercial off the shelf products reduced the equipment costs and made the course available to more people (46, 83, 94). The lack of travel costs for both students and instructors was another big savings for CBT (49, 65, 76, 94). Another form of savings was to store the course on CD-ROM instead of floppy disks. This resulted in a considerable savings in packaging and delivery time from 170 to 50 hours and decreased cost from \$4,320 in diskettes per year to \$384 in CD-ROMs for one location (80).

VTT, Videotapes, and Interactive Videodisk

The 35 articles in this section deal with DL via VTT, videotapes, or interactive videodisks. There were two main forms of VTT: one-way video with two-way audio and two-way video with two-way audio. The VTT was done both with a class in the broadcasting studio and without a class in the broadcasting studio. Some of the broadcasts went to one site and some were multisite. The videotapes were either stand-alone instruction or taped VTT for replay. The two main forms of transmission were via satellite or through fiber optic cable systems.

Of the 35 articles in this section, only one reported a significant difference in mastery of content where 'live' instruction was better than 'remote' (66). The rest of the articles that reported comparison results showed no difference or a difference that favored the DL group (4, 10, 36, 37, 48, 50, 57, 58, 61, 63, 65, 67, 88, 89, 92, 93, 95, 97, 100, 105, 106). Partnerships between major corporations and universities via VTT have resulted in increased enrollments for the universities, internship possibilities for the students, and consulting jobs for the professors (33).

Instructors for VTT need training in additional skills to be effective (19, 52, 54, 62, 74, 97, 100). Some of the additional skills needed include techniques to encourage interactivity and collaborative learning, plus the skills needed to operate the equipment. While it has been reported that instructors need more time to prepare for VTT classes than for traditional classroom (19, 27, 35, 63), it has not been documented whether it is initial learning or a continuing effect. Instructor involvement in the course development helped keep the development costs low and increased instructor perception of the course (74).

The development of the course materials for video transmission was more time consuming and costly than the course materials for traditional training (10, 63, 75). However, cost-benefit analysis (10) showed that even though the start-up costs were greater, VTT saved money over the long run. In nine sources, it was stated or concluded that it was essential that the course materials be reconfigured to include interactive activities and activities to keep the class interesting (11, 19, 35, 37, 57, 62, 63, 75, 97).

Even though many authors writing in the area state this is important and think reconfigured materials work when they use them, only one study (57) was found to directly compare reconfigured and nonreconfigured materials. That study did a direct comparison between reconfigured and nonreconfigured materials with all other variables held constant (57). The students using the reconfigured materials performed statistically significantly better than the students using the nonreconfigured materials. However, the authors suspected (57) that when the materials were reconfigured, the instruction was actually of a higher quality. It must also be pointed out that the 'candid classroom' approach (taping a traditional on campus class for broadcast) was just as effective as traditional training (4, 48, 50, 66, 93, 95) with no course conversion based solely on student course grades.

Two-way video was more costly than one-way video and none of the studies reported a significant difference that favored two-way. One-way video was found to be significantly better in two studies (57, 88), however, both studies questioned the validity of that finding. In those studies that only used one-way video, one-way produced the same or better results as traditional training (27, 37, 93, 95, 97). Interactive videodisk also produced the same level of effectiveness or better than traditional training (36, 58, 105). Hands-on or laboratory training was done successfully by interactive videodisk with the main difference being that the interactive group completed the lab in half of the time of the conventional group (58). Hands-on training was also done by VTT and by videotape. The groups trained by VTT performed no differently than the traditional groups (89). Two studies used videotapes to teach hands-on tasks. In one, students who were taught mechanic tasks by videotape performed as well as the traditional students and spent less time in instruction (48). In the other, students who observed videotapes instead of participating in a laboratory took longer to perform all test tasks and performed less accurately on two out of three (89).

Costs for a video system are expensive for equipment, transmission, and course conversion. Transmission cost varies and depends on the distance and the type of technology used (53). For shorter distances, if full motion video is essential, microwave technology is the most viable option (53). For longer distances, compressed video via cable is the least expensive to install and gives an acceptable level of fidelity. The costs of a satellite-based system had increased so much that video compression technology had to be used in Virginia (64). The major costs for any video system hardware were system consulting and design; materials, construction, and installation; terminal end points; and maintenance. To equip and install a two-way interactive classroom, the costs were approximately \$30,000. It was 30 to 70 percent cheaper to buy individual items to equip the classroom than to buy packages of complete systems (53).

Course conversion cost is the other major cost associated with video systems. If the conversion work was contracted out, the costs ranged from \$3,000 to \$12,000 or higher per hour of instruction time depending on the complexity of the material. If the conversion work was done in-house, the costs were significantly lower. The one factor that decreased course conversion cost the most was having the course in good condition before conversion. To be in good condition, the course had to be up-to-date and have

good presentation materials that were camera ready. The second factor that saved money was to have standards and guidelines developed for the course material which the contractor had to meet. For a simple course that was in good condition and had developed standards, the costs ranged from \$500 (done in-house) to \$2500 (done by contractor) per hour of instruction time. Complex courses that require lengthy update, videotape production, complex graphics, and had loose standards exceeded \$15,000 per hour of instruction time (75).

Savings for the use of VTT included the ability to train more students (51, 65, 74, 75).

Professional Education

The seven articles in this section deal with professional education. That is training of graduate students, advanced training for professionals, and officer and senior enlisted leadership training. Professional education traditionally has been costly and hard for students to get away from jobs to attend. In times of reduced training budgets for both the military and industry, it is more important than ever to find new methods for professional education. The articles in this section demonstrate various methods of delivering professional education while maintaining the quality of instruction. Seminars conducted by e-mail or other electronic devices allowed the students to stay on the job but receive the training they need.

Three of the seven articles compare traditional versus DL. In all three, DL students perform as well as or better than their traditional counterparts (89, 93, 100).

The Air Command and Staff College (ACSC) developed a multimedia course that was given in residence and at a distance. The entire course was put on multimedia and reconfigured at the same time. The course conversion work was done by student labor with instructor input. The updating of the course was done by students in team research projects. This allowed the students to receive better training and made the course conversion extremely affordable. By replacing the text-based delivery system with CD-ROM, the Air Force reduced the cost of the course delivery (72).

The United States (US) Navy delivered training for the Damage Control Petty Officer course and for Navy Leadership (NAVLEAD) training for leading petty officer and chief petty officer training via VTT. The Damage Control course was instructor led and the NAVLEAD training was largely student led. Measures of learning in both courses showed no difference between the VTT groups and the traditionally trained groups (89, 100).

Discussion groups or seminars play a large part in professional education, but these articles demonstrated that the seminars do not have to be face-to-face. Electronically delivered seminars whether by e-mail or bulletin board (42, 72, 78, 90) or by VTT (89, 93, 100) were an effective way of conducting these seminars. In fact, the e-mail and bulletin board afforded a degree of freedom to let those students reluctant to speak in a

group share their opinions freely (42, 90). The authors cautioned, however, that extra care was required to design the collaborative learning experiences (42, 72).

Student Interaction With Instructors, Other Students, and Technology

The 16 articles in this section deal with interaction in a DL environment. There are four types of interaction in a DL environment: learner-instructor, learner-learner, learner-content, and learner-interface (45, 69). Two-way video, two-way audio DL provided the same level of interaction as traditional classroom, but there were less expensive methods to obtain this interaction. Interaction in a one-way video, two-way audio environment could be done by two methods: the push-to-talk microphone or the one touch response system (OTRS). The OTRS is a keypad that has both audio and data transmission capability. Interaction was also done by telephone, e-mail, or computer bulletin boards.

The push-to-talk microphones and the OTRS provide realtime interaction. With the push-to-talk microphones, one was placed in front of each student or several were located centrally to be shared by several students. The student pushed a button which opened the communication line and asked his/her question. Classroom etiquette applied in that the student waited to be addressed by the professor before talking. In the case of multisite instruction, the student identified himself by name and location. The push-to-talk microphones were less expensive to purchase but had higher transmission costs than the OTRS (74). The OTRS provided adequate interaction in a number of settings (3, 51, 74, 97). It had the capability to provide learner-teacher interaction, learner-learner interaction, student registration and attendance, tests, and quizzes (74). Student satisfaction with the OTRS was high and training was effective (3, 51, 74, 97).

E-mail, computer bulletin boards, and telephone provide asynchronous communication. They can be used with any DL media. E-mail and bulletin boards provide students with a degree of anonymity and time to formulate questions and responses (16, 25, 34, 44). The instructor, through e-mail, can give students personalized attention to their questions. The questions and answers could be put on a bulletin board so that all the students can share in the discussion (16, 25, 34, 44). The phone system has the advantage of being available to everyone and could be used during class or after classtime at designated hours to reach the instructor or other students (16, 17, 38).

Interaction with the instructor was an important component of student satisfaction with DL. Instructors who had problems with student interaction may need training to increase that interaction (54, 63). In those courses where the student had direct interaction at least once through the course whether in person, by phone, or e-mail, the students rated the course highly, stayed in the course, and succeeded in the course (3, 15, 16, 17).

Interaction with the media was transparent when the equipment functioned properly. It was important that the students, instructor, and site facilitator know how to operate the equipment and what to do when it malfunctions (45, 79, 97).

Reviews of DL Literature

Seven reviews of DL literature are included in this section. These reviews summarize findings from several years of DL literature and cover civilian and military training from kindergarten to adult learning. Major conclusions drawn by these authors are summarized here. Only those findings that pertain to adult learning are included in the summary of this section.

Specific topics covered in the reviews include military training, attrition, learner achievement, perceptions and attitudes, instructor skills, and course development. Military training evaluations ranged from professional officer training to hands-on training. No significant difference in achievement was reported in any of the military studies and cost comparisons favored DL (2).

Evaluation of student achievement rated DL and traditional training as equal (2, 70, 84). In one study involving corporate training, real time interaction raised student material retention rates (84). Although students favored face-to-face learning, there was no difference in performance. However, attrition rates were lower when the student expressed a higher preference for the mode of delivery.

The attrition rate for DL was higher in most studies than traditional instruction. The reason for student withdrawal was a combination of personal and course related factors. It is not known if there were differences in the students enrolling in the types of instruction that may account for the attrition differences. Direct contact with the instructor increased student satisfaction with the course (15, 70, 79, 86) and those students who had a high level of satisfaction were most likely to complete the course (15). Student attitudes toward DL were linked to technology, teaching method, student-teacher interaction, and being a remote student. Increased reliability of the equipment and teacher interaction with the students during instruction also increased student attitudes (79, 86).

Instructor skills needed for effective DL were interaction skills, summary techniques, and good oral communication skills. The instructor also needed to be completely familiar with equipment operation (70, 79). Additional training for the instructors in those skills enhanced the DL experience (68, 70).

Course development for DL was more time consuming and interaction exercises should be included (79). The content of the course must be developed carefully to meet the needs of the student and instructor. The level of visual imagery must be balanced to avoid the traps of too little or too much visual stimulation.

Descriptions of Some Specific DL Programs

The 11 articles in this section describe specific DL programs and ideas that might be helpful to individuals or agencies embarking on a DL program. Programs from universities, state-wide systems, military, and international sources are included.

The Cooperative Program for Operational Meteorology, Education, and Training (COMET) at the University Corporation for Atmospheric Research developed Convection Initiation, a multimedia course designed to help weather forecasters interpret Doppler radar. The course emulated the apprenticeship model by implementing an expert into the course who introduced subjects, gave hints, and was available for questioning. Evaluations of the course were very positive, but it was very costly both in time and money to develop (8).

The Just-in-Time Lecture (JITL) project from Carnegie Mellon University (CMU) is a multimedia based interactive program. Just-in-Time lectures combine video, sound, high resolution slides, e-mail, and the Internet to offer a flexible and easy to use vehicle for distance education and training. Video or multimedia CBI typically required 300 hours of labor or more for 1 hour of lecture. The goal of this program is 10 hours of production time for 1 hour of lecture. At the time of the visit to CMU, the staff was able to produce a simple 1 hour lecture with about 30 hours of labor. The system is portable to both personal computer (PC) and Apple-based systems and runs on a Windows environment. It could be exported on CD-ROM or over the Internet (20).

University of Maryland at College Park had two collaborative learning programs with Indiana University and the University of Arizona (UA). The two programs provided training to master of business administration (MBA) students at the schools. Through the use of DL technology, the students were able to benefit from group projects involving students from different backgrounds with different viewpoints. The projects were costly in the amount of time that the instructors had to dedicate to develop and run the program (101).

Three state-wide systems are included in this section: Indiana (11), California (33), and Michigan (77). Ball State University in Indiana had wired 200 classrooms and laboratories with fiber optics information systems. This system was in turn wired to the state-wide fiber optics network and allowed the university to take the classroom to the student. The MBA degree could be earned entirely on television courses, and over 330 graduate students have participated at 60 corporate sites. California had a live interactive satellite system in place state-wide. Michigan had four state-wide telecommunications networks to deliver DL. Each of the networks was developed for a different purpose but contributed to the overall DL program in each state.

The DL programs for the military included in this section discuss using the Internet to deliver training (13, 73). The Naval Reserve Officer Training Corps (NROTC) utilized the Web by developing courses with existing tools. Any training document that was created by a word processor was readily transferred to the Web. Course revisions

were easily made and the files could be downloaded and stored to make local area changes (73). The US Army National Guard had funded a project in conjunction with Advanced Research Projects Agency (ARPA) to develop the Digital Library System for training materials. Designed as stand-alone training packages, the files were too big to transfer over standard modem lines in a reasonable amount of time. The solution was to use the Internet to transfer the main training with supplemental or optional materials to be stored and distributed on CD-ROM.

International programs in this section included articles from Canada (5) and Germany (91). In addition, Winders (103) presented a series of case studies from England, Scotland, US, Australia, Canada, and Israel. Three large DL networks that served Canada were discussed in detail (5). The electronic village which was a computer-mediated communication system that delivered five courses from the University of Western Ontario was a relatively low cost, low technology network. In contrast was LARG*net. LARG*net was a wide bandwidth network utilizing asynchronous transfer mode (ATM) technology to allow real time transfer of medical images of diagnostic quality. The third system discussed in detail was the sophisticated videoconferencing system used by three universities to share courses and instructors. The German Army developed a system to train their soldiers for out of area missions (91). These missions demand other skills in addition to regular combat skills. An extensive database had been combined with CBT training to give the soldiers the training they needed. Mission specific subsets of the data base were delivered through multimedia to the bases as the soldiers needed the skills.

Cost Effectiveness and System Costs

The cost of DL systems and their various components are discussed in the 18 articles in this section. There were very limited cost comparisons and effectiveness studies at the time of this literature review. Costs or savings are often measured in time savings rather than actual dollars.

DL systems were costly, but careful planning and extensive use of the courses could produce savings (10, 36, 48, 49, 65, 72, 76, 80, 94). The cost per student was lower than traditional training over a period of time because of the larger number of students that it was possible to train. Besides the dollar savings, there were savings in the amount of instruction time (47, 48, 55, 59, 65, 75) and the ability to train a larger number of people (51, 65).

The costs that should be considered for a DL system were: hardware, software, transmission, course conversion, and time to train the faculty and staff (63). The acceptable level of cost could be determined by the expected revenue minus the expenses. The acceptable level of interaction for the course was a big factor in the transmission and technology costs (63). These costs could average from \$100 to \$1000 per class hour depending on the level of interaction (30). Any materials that were delivered to the student and their associated costs were factored into the acceptable level of cost as well.

Technology and transmission costs for microwave, fiber optics, and compressed video were compared (53). For shorter distances that required full motion video, microwave was the most cost efficient technology. But for longer distances, compressed video via cable costs the least to install and maintain. If a fiberoptic system was already in place, leasing the system was the best alternative. DL classroom prices were also compared (53). The cost of the classroom could be reduced by 30 to 70 percent by buying the components separately instead of the complete package. Another advantage to buying the components separately was to get just the ones that were needed and add nice-to-have as enrollments and revenue permitted.

Course conversion costs could be reduced by doing the work in-house. Desktop-produced videos cost half as much as commercially produced video if a dedicated staff was trained in the process (48). Two main factors to lower course conversion costs were to have the course up to date with good presentation material and to have well developed standards and guidelines for the courses (75). Converting a traditional course to a video course ranged from \$500 per hour if done in-house to over \$15,000 per hour if done by a contractor. The more up to date the course and the better developed the standards, the lower the costs (75). Course conversion costs per hour for other media (65) include:

- Print - \$1300 to \$5000
- CBT - \$4000 to \$14,000
- IVD/CD - \$4000 to \$19,000
- Videotape - \$8300 to \$17,000

Two other ways to reduce costs were also discussed. The production and delivery costs of CD-ROM material over traditional material are considerably less (72, 80). Forming consortia to share technology, transmission, and course conversion costs helped universities to offer a wider range of classes to more students at a reduced cost (24).

Miscellaneous

The 10 articles in this section are deemed of value to those interested in DL but do not fit neatly into any of the other sections. The placement of the articles in this section in no way reduces the importance of the information.

Two of the articles in this section contain listings of distance education programs (credit and noncredit) for all levels and types of instruction (26, 29). They are included in the bibliography for interested agencies.

Dede (23) gave a look into the future where he proposed that distance education would be replaced with distributed learning. The difference between the two was distance education automated the old message, but distributed learning would redefine the way we educate by using a new methodology to create more effective training. Some of the methods discussed were knowledge webs, interactions in virtual worlds, experiences in synthetic environments, and sensory immersion.

Interactive courseware had evolved to a new level with the addition of interactive three-dimension (3D) (39). The costs for this technology are coming down but are still high. Golas and Montag cautioned that the use of 3D should only be considered for courses that contained the following components:

- A need for a high degree of realism.
- A need for dynamic spatial scenarios to train complex tasks.
- Emerging systems.
- Video cannot depict the object or scene.
- No other option, simulation and personnel only get one chance to do it right (ex. National Aeronautics and Space Administration (NASA)).

The need for this level of fidelity must be carefully weighed with the cost and difficulty of producing.

Heinlein (43) proposed a synthetic environment for education based on the current development of the distributed interactive simulation for military use. This environment could be a coordination platform for an integrated curriculum. Another proposal for use of the distributed interactive simulation (40) proposed combining it with interactive television to deliver DL including hands-on user interaction and remote simulator training.

Litton-FiberCom described some of the technology of DL and how it worked (60). This particular system used ATM technology. The authors recommended contracting with the local cable company or power company to install a fiber optic system as they were lower in cost than the phone company to install. Another option was leasing fibers from the phone company.

Sheets (85) reviewed the literature on characteristics that might predict student success in a DL program. Student success was measured by completion of the course with a passing grade. The findings comparing distance students to conventional students yielded some information about who chooses to participate in each program but were not designed to predict factors for success. Some factors found were that older students had higher completion rates and those students who were enrolled for college credit or employment certification were more likely to succeed.

Twigg (98) compared the teaching infrastructure of the traditional college with the learning infrastructure of the DL systems. It was concluded that the teaching infrastructure was too expensive and no longer a viable option for a large majority of the population. A national learning infrastructure would supplement the teaching infrastructure and deliver training where and when the student needed it.

Winkler, Kirin and Uebersax (104) proposed a method to link US Army individual training programs with three different training concepts. The three concepts were distributed training; training aids, devices, simulators, and simulations (TADSS); and civilian education exchange. Based on factor analysis, they suggested certain military occupational specialty (MOS) training programs that should be taught by the three training concepts.

Choices for DL Delivery Systems

A list of courses addressed by this literature review are presented in table 2. Type of media, course title, and level of instruction are included. A listing of delivery systems with major advantages, disadvantages, and approximate costs (28) are presented in table 3. This is followed by table 4 which contains a crosswalk of delivery systems and interaction systems available for each. The developer of DL training must first decide on the format of the different portions of the course. Then a careful matching of the delivery systems, interaction system, and course content while considering costs must be done.

Table 2. Courses Taught by Type of Media

Type of Media	Course	Level of Instruction
Print	Chartered Life Underwriter Nursing Issues	Professional Certification
CMC	Anthropology	Undergraduate
	Anthropology*	Undergraduate
	Briefing and Presentation Skills	Seminar
	Business French	Undergraduate
	Clinical Psychology	Graduate Seminar
	Engineer	Military Seminar
	English*	Undergraduate
	Geography*	Undergraduate
	Group Problem Solving	Graduate Seminar
	History	Undergraduate
	Human Organizational	Graduate Seminar
	Human-computer Interaction*	Graduate Hands-On
	Instructional Computing	Graduate
	Intro to Sociology	Undergraduate
	Leadership	Seminar
	Leadership	Military Seminar
	Management	Undergraduate
	Organizational Communication	Undergraduate
	Philosophy*	Undergraduate
	Research & Statistics	Undergraduate
	Statistics	Undergraduate
	Statistics	Graduate
	Tactics	Seminar
	Technical Engineering	Seminar
	Writing*	Undergraduate
CBI; CAI Multimedia	BNCOC-Common Leader Training	Military Specialty
	Classroom Management	Graduate Seminar
	Commercial Accounts	Military Specialty
	Convection Initiation	Professional Certification
	French	Military Specialty
	German Army NCO	Military Specialty
	Mission Adaptable Learning*	Military Specialty
	Personnel Administration Specialist	Military Specialty
	Professional Military Education	Military Seminar
	Spanish	Military Specialty
	Specialized Undergraduate Pilot Training	Military Specialty

Table 2. Courses Taught by Type of Media (Continued)

Type of Media	Course	Level of Instruction
VTT; IVT Videotapes	Air Worthiness Inspector Cockpit En-route Inspection Alcohol Testing Basic Military Police (Phase 1) BNCOC-Common Leader Training Chief Petty Officer Communicating with Others Continuing Education to Nurses Damage Control Petty Officer Division Officer Education Electrical & Computing Engineering Gathering & Organizing Info Handling Hazardous Waste Hazardous Materials Handling Industrial Engineering/Operations Research Leading Petty Officer Library Science Light Wheeled Vehicle Repair Management of Technology MBA Courses*	Professional Certification Professional Certification Military Specialty Military Seminar Navy Leadership Seminar Professional Certification Professional Certification Military Hands-On Navy Leadership Seminar Graduate Graduate Professional Certification Military Specialty Professional Certification Graduate
	National Airspace System Overview for MCC Specialist Presenting Info to Others Problem Solving Strategies Quality Assurance Training Systems Special Education Supervisors Administration and Operations Course Total Quality Leadership Unit Administration Specialists Unit Supply Specialists	Professional Certification Professional Certification Professional Certification Graduate Graduate Professional Certification
AC	History Intro to Psychology Money Management Nursing Issues Special Education	Undergraduate Undergraduate Undergraduate Undergraduate Graduate
Interactive Videodisk	Army Communication Training Biology Concepts CGSC Neuropathology Science Process Skills	Military Hands-On Undergraduate Lab Military Seminar Graduate Undergraduate Lab

*Courses that were not evaluated for effectiveness.

BNCOC - basic noncommissioned officer

CAI - computer-assisted instruction

CGSC - Command and General Staff Course

IVT - interactive video teletraining

MCC - maintenance control centers

NCO - noncommissioned officer

Table 3. Choices of DL Delivery Systems for a Course

Delivery System	Advantages	Disadvantages	Cost*
AC	Low cost, can be accessed from any phone	Fewer capabilities	Approximately 50 cents per line per minute
Audiographics	Low delivery costs, lower capital costs, as effective as video for subjects not requiring motion	Software package requires some practice to become proficient, students must be self-motivating	Software approximately \$2,000 per site plus \$5,000 for a bridge if more than two sites; ongoing charge of conference call telephone charges
One-Way Analog Video	Cost effective if sharing facilities, as effective as class room training, classroom model makes it feel familiar, program can be taped for reuse	Requires substantial preparation and advance planning; analog may be replaced by digital	\$20,000 for a 2 hour broadcast; antenna cost \$3,000 to \$7,000
One-Way Digital Video	Instructionally effective, cheaper than analog	Users are tied to the vendor	Integrated receiver/decoder \$2,300, satellite time is \$150 per hour
Two-Way Digital Video	Requires less support than one-way video	Requires special communication lines, maximum number of participating sites is 32, typical video room holds 20 people, quality of video depends on bandwidth, low bandwidth makes video jerky	Video room costs between \$30,000 and \$60,000; communication charges are about \$100 per hour per site plus \$400 per hour for bridge site
CMC	Convenient, low cost, only requires a PC, a modem, and a phone line, effective supplement	Motivation must be high for student to continue	Phone charges for transmission time

*28. Federal Training Network 1995. These costs are meant for comparison only and may not reflect the costs available presently.

Table 4. Types of Delivery Systems by Interaction Systems

Delivery System	Interaction System					
	Mail	Phone	E-mail	Listserv	One-Touch	Push-to-Talk
Print	A	A	A	A		
Audiotape	A	A	A	A		
AC		R				
Audiographics		R				
CBT	A	A	A	A		
Computer-Mediated	A	A	A	A		
Multimedia (CBT)	A	A	A	A		
Two-Way Audio					R	R
One-Way Video					R	R
Two-Way Audio					R	R
Videotape	A	A	A	A		

A = Anytime
R = Only real time

Major Findings

All forms of DL are at least as effective as traditional instruction in most instances. In the studies reviewed, a wide variety of topics and time periods successfully used DL media. DL is also effective for a variety of class types to include: seminars, group instruction, individual training, hands-on, and laboratory.

Course development for DL could be costly, but the number of people trained could recoup the costs quickly. Courses that were up-to-date and organized were cheaper to convert than out of date courses. The issue of reconfiguring of materials would merit additional research. Fully developed standards and guidelines for the course converter could result in lower costs.

Instructors for DL would at least initially need training in interaction skills, summary techniques, oral communication skills, and DL equipment operation. VTT instructors would also need training in VTT techniques.

Interaction between the students and the student-instructor was a concern in many DL studies. These interactions could be improved with bulletin boards and e-mail. Direct student-instructor contact improved student perception of the course and increased the completion rate.

Costs for both the technology and course conversions were high, but higher enrollments over a period of time would offset the costs. A careful match of the training needs and technology available could result in cost savings.

Although DL had a higher attrition rate than traditional instruction, the studies reviewed suggest the motivation of the student and personal factors were the cause more than an effect of the technology.

Implications for the Army

The literature review supports incorporating DL programs into US Army training because of the wide range of media that were used successfully for a variety of subjects.

The US Army should consider all forms of DL media. The specific learning needs should dictate the type of media used.

DL requires more training development resources up front, however, these additional resources can be recouped over the life of the program and may be less expensive in the long run.

Instructor training must be developed that includes techniques for best utilizing DL technology.

Instructors will require more preparation time for DL courses at least initially.

Careful planning is required to choose the most cost effective system for the course. The most expensive systems (two-way, full motion systems with fully reconfigured materials) may not be needed for every course. Interaction alone does not justify the expense of two-way video. Interaction can be achieved via e-mail, bulletin board, telephone or fax.

Professional education could be done without taking officers and noncommissioned officers (NCO) out of the unit. Furnishing the soldiers with computers and Internet access and converting the course to some form of DL media could suffice.

The literature review indicated that attrition rates, which were higher for DL, can be lowered by improving student attitude toward DL through direct contact between the soldier and the instructor. Attrition was also lowered by high motivation factors.

Training of an in-house staff to convert courses to DL would be cheaper than contractor conversion.

Candidate courses for DL should be up to date with standards developed for the conversion.

Low density courses might not be cost effective to convert to DL.

Training developers in the US Army must keep abreast of the technologies and changes to ensure quality DL experiences.

Annotated Bibliography

1. Bajtelsmit, John W.; 1990; Study Methods in Distance Education: A Summary of Five Research Studies in Michael G. Moore, Peter Cookson, Joe Donaldson, and B. Allen Quigley, eds; Contemporary Issues in American Distance Education; New York: Pergamon Press; 181-191.

Presents an examination of different study methods used by distance learners in a professional certification course given by the American College. The course outcome was measured by a standardized achievement test at the conclusion of the course that was prepared and graded at Bryn Mawr. The standardized test was the only score the students received for the course. Students were given the choice of studying completely on their own or attending classes at various locations.

The first study surveyed 375 students to determine the study methods that they used. The two most often used was self-study using materials endorsed by the American College and the classes. Although there were some students who did self-study with materials not endorsed by the American College, the sample was small enough that it was not considered a factor in the follow-on studies. The second study investigated the relationship between study method and performance on the exam. No significant differences were found between the two groups: self-study and formal class.

The third study examined the interaction between educational backgrounds and methods. Study subjects were 1000 randomly selected students taking the first course in the chartered life underwriter (CLU) series of 10 courses. Preliminary studies showed that 56 percent of the students participated in the formal classes and 33 percent did self-study. The study indicated that educational level was a significant predictor of adult examination performance in this nontraditional setting. It also suggested that students with only a high school diploma benefited from the structured learning in the formal classes.

The fourth study explored the relationship between study method and anxiety on CLU examination performance. The sample consisted of 87 students who had completed 4 years of the CLU courses. There were no differences between the self-study and formal class students in overall exam performance. When comparing anxiety levels to study methods and exam performance, high anxiety students performed better in the formal class method, and low anxiety students performed better in the self-study method.

The fifth study examined the effects of study method on essay as well as objective exams. Subjects for this study were 191 CLU students who had completed the recommended 4 combined objective/essay tests over 4 consecutive years. Results showed that formal class students did better on the essay portion of the test, but there was no difference on the objective portion of the test. The results of these five studies suggested some measure of counseling to students when presented with a choice of study methods.

2. Barry, Michael and Runyan, Gregory B.; 1995; A Review of Distance Learning Studies in the US Military; *The American Journal of Distance Education*; 9 (3); 37 - 47.

Presents three aspects of DL in military settings: delivery systems; studies comparing the effectiveness of DL with comparable resident training; and speculation as to the future of DL in military settings. The delivery systems in the last 15 years ranged from two-way audio with hand-written images and still-frame video to two-way full-motion video with two-way audio. Eight effectiveness studies in this review showed no significant differences in achievement between distance learners and resident learners while cost comparisons favored DL. The courses used for these studies were from the US Navy, US Army, and US Air Force. The subjects of the courses ranged from professional officer training to hands-on training.

3. Baehr, Dr. Cj; 1996; Interactivity with Response Technology: Connecting Students, Instructors, and Content; *ED Journal*; 10 (2); J-7 - J-10.

Presents another solution, besides expensive two-way video, to establishing interactivity between students and instructor. Data response technology via a keypad for each student has been used successfully in a variety of programs and at less expense. The OTRS included a microphone built into each keypad allowing the instructor to control all incoming audio. Through the use of the keypad not only could the instructor receive answers from the students, he could also poll the students to ensure that the instruction material was being understood. The cost of a beginning system which included the host and remote site equipment for five sites was less than \$50,000. Evaluation consisted of improved student scores over a shorter period of time with the use of the keypad response.

Several DL degree courses have been transmitted to Ford Motors worksites from Wayne State university using the OTRS. The distance education format allowed the students to cover their courses in 80 percent of the time previously required in the traditional setting. In addition, scores improved 17 to 19 percent. Hewlett-Packard also included the OTRS in their distance education program. The student-instructor interaction, as rated by students taking courses at the Chrysler

Corporation, was rated as adequate by 83 percent of the students. The more the keypad was used, the higher the rating for interactivity.

4. Beare, Paul L.; 1989; The Comparative Effectiveness of Videotape, Audiotape, and Telelecture in Delivering Teacher Education; *The American Journal of Distance Education*; 3 (2); 57 - 66.

Presents a comparison of six different alternative delivery systems for instruction of a graduate level class in special education. The class was a semester long and open to both graduate and undergraduate students. There were a total of 175 subjects, 92 undergraduates, and 83 graduate students. The six instructional formats were: lecture, lecture with video backup, telelecture, audio-assisted independent study (AAIS), video-assisted independent study (VAIS), and video on campus (VOC). The VOC format was a special condition and created specifically for the research. The students in the VOC class were given the choice of taking the class by video or waiting until the next semester to take the course. The outcome measures were percent correct on the three exams in the course and course evaluations.

There were no differences in student performance on any of the tests when comparing instructional media. There was a difference between graduate and undergraduate scores. For the course evaluation questions there were no differences between the groups. There was a difference between the VAIS and VOC groups on the question about willingness to take a video course again. The VAIS group were more willing to do so. When faced with the clear option of face-to-face instruction versus distance, there was a clear majority who preferred face-to-face. However, "distant learners found the course just as stimulating, were equally interested in the subject matter, and judged the instructor equally as skilled as did those receiving face-to-face instruction" (p. 65).

5. Bradley, John and Peacock, Kent A.; 1996. Connecting to the Global Classroom: Distance Education in a University Setting; *ED Journal*, 10 (2), J-17 - J-24.

Presents electronically mediated distance education. The potential advantages of distance education were listed as:

- Students from a wide geographic area have access to the resources of a central university.
- Allowed the participation of students who were unable to be full time students.
- Allowed participants access to a greater range of options.
- Allowed new modalities of instruction or self-instruction (such as the World-Wide Web).

- Greatly increased the educational options available to the handicapped.
- Frequently was cheaper than conventional modes of education.

An example of CMC from the University of Western Ontario was the electronic village. The electronic village had five courses available (english, anthropology, geography, philosophy, and writing). The user signed on to the system and selected his course or conference. Messages could be waiting from the instructor or other students. The user could read the messages at his leisure and respond privately by e-mail or to the group using a bulletin board. Assignments could be uploaded and downloaded. There was a capability for all students to log on at the same time and have a real time conference, but the real advantage to the system was the capability for each student to take the course at the time most convenient to him. The electronic village was relatively low cost, low technology, and accessible to a large number of users.

In contrast was LARG*net. LARG*net was a wide bandwidth network utilizing ATM technology which was used to allow realtime transfer of medical images of diagnostic quality. It was the first ATM network in Canada to be directly connected to the Internet. It had enormous potential for educational applications at the graduate and professional level but was a high cost, high technology, and available only to a few.

Another type of technology available in Canada was the sophisticated videoconferencing system used by the Universities of Guelph, Waterloo, and McMaster. The link between Guelph and McMaster was T1 phonelines which allowed for the transfer of high quality full motion video and the link between Waterloo and Guelph was via microwave. Only two sites could be on-line at any one time. The instructor could choose two modes of communication, the "discussion" mode in which all microphones were open at both sites or the "class" mode where all but the instructor microphone were silenced and the student must push a button to talk.

The author concluded his article with a description of four other low technology networks that existed in Canada. The trend for distance education, as seen by this author, was a need for both low technology networks to economically reach a large number of students with higher technology networks available for the relatively sophisticated and focused students at a higher level.

6. Brodie, Kay; Bronson, John; Coble, Joan; and Gray, Doug; 1994; Distance Learning Interactive Classroom Faculty Guide; Office of Continuing Education and Learning Resource Center; Chesapeake College; Wye Mills, MD; taken from the internet, October 1996, at address <http://www.chesapeake.edu/Dislearn/facguide.html>

Presents guidelines used by the Chesapeake College faculty. There were some general tips that were not site specific. The instructor needed to make plans ahead of time to ensure that the class received all class materials in a timely manner, to make arrangements for security of tests and quizzes, to plan for equipment breakdown, and to make arrangements for student conferences. On the first day, the instructor should make sure the students understand how to operate any equipment required, introduce students at all sites to each other, and make sure classroom seating arrangements were made for optimal viewing. During presentations, the instructor should strive to make eye contact with the students at all sites, encourage student interaction between sites, be energetic, and try to call students by name. Active learning strategies that were useful in the traditional classroom should also be used in the DL environment such as group work, discussion, peer critiques, oral reports, and computer simulations.

7. Burge, Elizabeth J. And Howard, Joan L.; 1990; Audioconferencing in Graduate Education: A Case Study; *The American Journal of Distance Education*; 4 (2); 3 - 13.

Presents data from AC classes at the Ontario Institute for Studies in Education. Because of the low cost of the technology many classes were offered using AC. Survey data from 14 courses with 120 respondents were analyzed. Although data from one case study in graduate level learning may not be generalizable, the results indicated some areas that educators may want to explore further. For the most part the students were satisfied with the AC learning experience but had some concerns about the quality of the audio reception and interaction within the classroom. They suggested that the instructor or facilitator be personal, stay in control of the discussion, and provide timely feedback. The students also felt that their fellow students should have good presentation and communication skills.

8. Casey, Carl; 1996; Incorporating Cognitive Apprenticeship in Multimedia; *Educational Technology Research and Development*; 44 (1); 71-84.

Addresses apprenticeships and mentor relationships which have been an established part of our educational process for many years. The expert instructed, guided, and corrected the novice gradually playing a lesser and lesser role as the novice became more like the expert. This form of education was not possible for someone in a remote site doing individual instruction. The author described a system developed to address this need which was cognitive apprenticeship training delivered through a multimedia platform.

The author discussed the problems of the designers. "Issues facing designers of instructional multimedia were numerous and profound: an audience that was often not part of a community-of-practice, where

learning occurred in a communal environment of discussion, analysis, and reflection; a diverse audience having varying levels of subject matter expertise, metacognitive skills, man-machine interface skills, and motivation; an ill-structured subject matter; and problematic learning environments" (p. 71).

This article described Convection Initiation, a multimedia course designed to help weather forecasters interpret Doppler radar. The course was developed by the COMET at the University Corporation for Atmospheric Research, Boulder, CO. The course emulated the apprenticeship model by implementing an expert into the course who introduced subjects, gave hints, and was available for questioning. The major findings from the research were:

- "Cooperative learning environments seemed more successful than individualized learning conditions" (p. 81). Students who had discussions with other colleagues about the course material were more motivated and seemed to process the information at a higher level.
- The apprenticeship model was positively received and there was a great deal of interaction with the 'expert.'
- The hypertext had to have a cognitive organizing framework for the beginning learners.
- The instruction through the use of the various apprenticeship formats was interactive and engaging.
- Learners who had a higher level of experience tended to try to operate first without the information, then if they failed, go and look for the information needed.
- Learners felt that Convection Initiation was a pleasant departure from traditional 'talking-head' instruction.
- The training became a topic of discussion in some offices promoting additional learning.

The author cautioned that while this method of instruction was worthwhile, it was very costly both in time and money to develop.

9. Cheng, Hui-Chuan, Lehman, James, and Armstrong, Penny. 1991; Comparison of Performance and Attitude in Traditional and Computer-Conferencing Classes; *The American Journal of Distance Education*; 5 (3); 51-64.

Compress the effectiveness of using computer-conferencing for delivering a graduate-level computer course of remote sites to using face-to-face instruction on campus. The course, "Microcomputer Applications in Education and Training," was a 3 credit graduate education class at Purdue University. The study looked at three variables: achievement test scores, time-on-task, and student's attitudes.

Because of hardware and software problems, the remote students became two groups; one learned from correspondence and the other from computer-conferencing. A comparison of demographics found there were some significant age differences in the groups and age was used as a covariate. Students taking the course by correspondence did better on the posttest, however, there were no significant differences on semester scores for any of the three groups. There were no significant differences for time-on-task. Off-campus students did view the course less positively than their on-campus counterparts, but the majority said they would take the same type of course in the future. Overall, the results from the study suggested that computer-conferencing can be an effective means of instruction for universities.

10. Chute, Alan G., Bathazar, Lee B.; and Posten, Carol O.; 1990; Learning from Teletraining: What AT&T Research Says; in Michael G. Moore, Peter Cookson, Joe Donaldson, and B. Allen Quigley, eds; Contemporary Issues in American Distance Education; New York: Pergamon Press; 260-276.

Summarizes 5 years of learning from teletraining in the corporate environment. Teletraining used three delivery media: audio, audiographics, and video. Instructional effectiveness was separated into five components: learning, acceptance, appeal, expectations, and attributions.

From the studies that American Telephone and Telegraph (AT&T) had conducted, there were no significant differences between face-to-face instruction and teletraining for both learning and acceptance.

To increase the appeal of teletraining, focus should be oriented on the instructional elements, social needs (personal contact with instructor), and innovative uses of technology. The expectations of the students before taking the course and which elements of the course attribute to the success and failure of the students should also be examined.

When AT&T did cost-benefit analyses, the start-up costs for teletraining were higher than face-to-face but, the long term savings for teletraining proved to be a very cost-effective alternative to face-to-face instruction. The authors finished the article with descriptions of some of the systems that AT&T had developed for audiographics and student response systems.

11. Cirtin, Arnold; 1995; The MBA Degree on Television: Distance Education for the Upwardly Mobile; DEOSNEWS; 5 (3); 1-5.

Describes the use of television to teach courses at Ball State University in Indiana. Two-hundred classrooms and laboratories were equipped with fiber optics video information systems and color monitors. This allowed

students and professors to tap into the library's inventory of videos, films, laser disks, and other media. This in turn was connected to state-wide fiberoptics network which allowed Ball State to take the classroom to the student via a closed circuit statewide television network. Classes were taught live with a class in the studio classroom and distant learners connected with one-way video and two-way audio. Distant students could participate in classroom discussion via digital teleresponders. The MBA degree could be earned entirely by television courses. Over 330 graduate students have taken the MBA course at 60 corporate sites in Indiana and Kentucky. The author taught a class in financial accounting and discussed techniques to present the material using screen graphics, video tape, music, still pictures, and computer presentations to keep the class interesting.

12. Clark, Richard E.; 1994; Assessment of Distance Learning Technology; in Eva L. Baker, and Harold F. O'Neil Jr. (eds) Technology Assessment In Education and Training; pp. 63 -78; Hillsdale, NJ: Lawrence Erlbaum Associates.

Discusses delivery technology, which was the media used to deliver the instruction, and instructional technology, which was the method of delivering the instruction. Some examples of instructional technology were ways to sequence or structure lessons, the use of examples, practical exercises, and tests. Clark maintained that many DL evaluations have confused the two and gave the credit to the media for student improvement rather than the instructional technology. Questions to evaluate each of the technologies were suggested. For instructional technology Clark proposed the following questions:

- "1. Which of the curriculum and teaching methods choices in a given distance learning program impacted student achievement and subsequent ability to use the knowledge acquired outside of the instructional setting?" (p. 69).
- "2. What impacted student and teacher motivation to learn and invest effort in making this program a success?" (p. 70).
- "3. Which of the curriculum and teaching method choices in a given distance learning program impacted: (a) students and teacher values for what was learned and (b) subsequent motivation to teach and learn and to use what was learned outside of the instructional setting?" (p. 71).
- "4. Which of the curriculum and teaching method choices in a given distance learning program impacted the cultivation of different kinds of knowledge, including procedural skills and higher order thinking, learning-to-learn, and meta-cognitive skills?" (p. 71).

The three questions proposed for delivery technology were:

"1. Did the distance learning media maximize student access to new, and/or high-quality courses and teaching when compared with other choices?" (p. 72).

"2. Did the media influence the utilization of school and community educational resources (e.g., space, equipment, skilled teachers, new courseware developed at one site but not readily available at others)?" (p. 72).

"3. Are distance learning media more reliable than other alternatives?" (p. 73).

The last part of this article discusses the cost-effectiveness evaluation which again should address both the delivery technology and the instructional technology. Clark recommended the "ingredients method" developed by Levin at Stanford University. All of the components or ingredients of each of the two technologies should be identified and costed separately and then summed together. In conclusion, the author suggested that evaluation must be considered from the very beginning of the project and be in the planning process as well as evaluation of the completed product.

13. Cohen, Gary A.; 1995; Architectural Analysis of Distributed Multimedia Training Libraries for Home-Based Users; Paper presented at 17th Interservice/Industry Training Systems and Education Conference, Albuquerque, NM.

Discusses the problems encountered in the Digital Library System for Training Materials Project funded by ARPA and the US Army National Guard in conjunction with the Simulation in Training for Advanced Readiness (SIMITAR) project. The developers of the digital library discovered that the CBT packages that were being loaded into the digital library were not readily retrievable by the average user of the library. Designed as stand-alone training packages the files were too big to transfer over standard modem lines in a reasonable amount of time. Portions of the CBT were not suitable for transfer by modem at all.

The authors of this paper proposed the use of a hybrid architecture that made optimal use of public network bandwidth and accessibility, while providing an access path to full multimedia presentation. This hybrid architecture involves using hyper text markup language (HTML), hyper text transfer protocol (HTTP), and file transfer protocol (FTP) to implement the training materials and to distribute them to remote users. Those portions of the files that were too big to be distributed by HTTP servers were stored and distributed on CD-ROM. The training developer should be careful of the size files developed and ensure that the lesson can be packaged for home-based use. The material stored and delivered by

CD-ROM should be supplemental or optional material that may enhance the lesson but the student could learn the lesson without it.

14. Coldeway, Dan O.; 1990; Methodological Issues in Distance Educational Research; in Michael G. Moore, Peter Cookson, Joe Donaldson, and B. Allen Quigley, eds; Contemporary Issues in American Distance Education; New York: Pergamon Press; 386-396.

Discusses different methods of performing DL research. A review of distance education research in 1982 by this author criticized the research for not being planned or conducted in a systematic manner. This increased the difficulty of determining the important effects of the research. Since that review, research in distance education has grown in importance to the DL community. The author proposed three different methods and gave the strengths and weaknesses of each.

The first was triangulation, which was the process of supporting a finding by showing independent measures that agree with it or at least do not contradict the finding. The second was component research, whereby all the different components of a DL system were identified and the relationship between the components and the learning process determined. By establishing the contribution of each component and its importance to the process, cost and effort could be based on a hierarchy of need. The third method was model-building. By reviewing the literature and identifying the variables of a DL system, a model could be built to establish the optimum mixture of the variables for an effective DL program.

15. Cookson, Peter S.; 1990; Persistence in Distance Education: A Review; in Michael G. Moore, Peter Cookson, Joe Donaldson, and B. Allen Quigley, eds; Contemporary Issues in American Distance Education; New York: Pergamon Press; 192-204.

Presents a review of the literature on persistence in distance education or its opposite, attrition in distance education. The conclusion was that the reason for student withdrawal was often a combination of factors, both personal and course related. The author had drawn 14 recommendations from the literature for the institution to intervene and reduce the number of withdrawals. Direct contact with the students either by phone, visit, or personal e-mail seemed to have a positive effect on students' attitudes and persistence. Those students who had a high level of satisfaction with the course were the most likely to continue with the course. The author suggests that more research in this field should produce more definitive answers.

16. Coombs, Norman; 1989; Comparison of Computer and Audioteleconferencing: One Instructor's View; New Horizons in Adult Education; 3(1); 1 - 7.

Compares using a computer to using AC for enhancing interactivity in a telecourse. The courses discussed were history courses taught by the Rochester Institute of Technology. The limitations of the comparison were that there were many different configurations of both computer and AC and this was a comparison of just one, made strictly on one professor's observations. The computer-conferencing was done via e-mail and PC asynchronously. Both the class and the conferencing could be done at any time most convenient to the student. Computer-conferencing was perceived as a very democratic setting without the physical attributes of the students influencing the discussion. "The relative anonymity of the conference also creates a surprising openness and frankness; students seem to share more freely and personally" (p. 3). Scores for the computer-conferencing class were compared with a traditional class on the same subject and no differences were found. The students rated the accessibility of the instructor at 4.8 on a 5-point scale. When comparing the total course to face-to face situation, they rated the telecourse at 4.2 out of 5.

The AC course was constrained to a classroom at a fixed time so the students did not have the flexibility that they had in computer-conferencing. While this mode allowed immediate feedback and peer discussion, the instructor felt it was more difficult on his part. The conferencing was done via telephone lines and 'dead' time was especially troublesome. The AC led to more stilted interaction than the computer-conferencing, but there was interactivity between the students. Both modes of conferencing worked, AC required more prior preparation on the part of the instructor and lacked the flexibility of computer-conferencing but allowed for immediate feedback and interactivity among the students.

17. Cragg, Catherine E. 1991; Nurses' Experience of a Distance Course by Correspondence and Audio Teleconference; *Journal of Distance Education*; 6 (2); 39 - 57.

Investigates the experience, learning strategies and reported learning of nurses taking a nursing issues course. The course was given by teleconference in a group-oriented format from two universities in eastern Canada and by correspondence in an individually-oriented format from two other universities in western Canada. Six students from each university participated in a semistructured telephone interview that lasted from 50 to 90 minutes. The one factor that stood out among all students was the high degree of self motivation. Family, spousal, and employer support were another factor that determined success of the program. Even though most of the women would have preferred a face-to-face class, the convenience of DL was a prime factor in the decision to take the course by DL. Individual learning styles influenced the degree of satisfaction with the type of class they had. Those who needed visual stimulation found the AC class lacking but those who liked studying alone

were extremely satisfied with the correspondence course. The most frequent comment about learning styles was the need to interact with the teacher. Those professors who took the time to phone the students or make one visit to a distant site were appreciated. Availability of local resources and the attitudes of the university staff toward the students also affected the degree of satisfaction with the course. "Often they were learning in spite of, rather than because of, the teaching method used" (p. 39). Resocialization to professional attitudes and changes in attitude were also reported by the majority of participants.

18. Curry, Bruce and Moutinho, Luiz; 1992; Using Computer Simulations in Management Education; *Management Education and Development*; 23 (2); 155-167.

Addresses the level of computer skills that managers and students should have; the specific advantages that computers could bring to the management arena; how to select the hardware and software package; and discusses some evidence for the effectiveness of the computer based approach. A number of studies were discussed which provide evidence that the use of computer simulation enhanced the motivation of the student, improved long term retention of the material, and improved test scores.

19. Cyrs, Thomas E. and Smith, Frank A.; 1990; *Teleclass Teaching: A Resource Guide*; New Mexico State University; Las Cruces, NM.

Provides a guide for instructors or trainers who were designing a new telecourse, adapting existing courses to telecourse format, or conducting a video teleconference. A step-by-step guide from the initial planning straight through to the copyright procedure was contained in this volume. Although the technology discussed was dated, it was still used at many locations and most of the chapters were not technology specific. The emphasis on planning ahead and being fully prepared for the telecourse experience made this document highly useful. Tips were included on everything from how to dress, move, and gesture in the classroom to how to best organize your material for maximum use of the broadcasting time. The chapter on working with your site facilitator emphasized the importance of defining the role of the facilitator prior to the course start to decrease any friction between the instructor and the facilitator. There were several chapters devoted to student interaction and how the instructor can ensure that the interaction was meaningful and helpful to the students. There was also a chapter on how to develop your own faculty teleclass teaching program.

20. Dannenberg, Roger B.; Grasso, John T.; Liebhardt, Edward; and Swasey, David; August 1996; Interview; School of Computer Science; Carnegie Mellon University, Pittsburgh, PA.

Describes the development of JITL. The JITL project was developed by the effort of the School of Computer Science at CMU and was conceived and sponsored by the Dean, Dr. Raj Reddy. JITL combined video, sound, high resolution slides, e-mail, and the Internet to offer a flexible and easy to use vehicle for distance education and training.

The components of the system were based on enhanced video, presented through PCs. Added to the video were synchronized slides, scrolling lecture outline, a window for frequently asked questions, and e-mail capability. Video or multimedia CBI typically required 300 hours of labor or more for 1 hour of lecture. The goal of this program was 10 hours of production time for 1 hour of lecture. At the time of the interview, the staff was able to produce a simple 1 hour lecture with about 30 hours of labor. The system was portable to both PC and Apple-based systems and ran on a Windows environment. It could be exported on CD-ROM or over the Internet.

The materials needed from the customer were: a course or topic with clear objectives, an outline, an experienced lecturer, and the desired supporting materials. The lecturer only needed to provide time enough to tape the video.

The steps for producing a 1-hour lecture were:

- Initial 2 hours shooting video, saved to S-VHS video tape.
- Transfer S-VHS analog to digital video.
- Compress video.
- Convert slides to QuickTime.
- Build course index, tie to lecture video, slide video, and frequently asked questions.
- Assemble materials using JITL authoring software.
- Make CD-ROM, backups, etc.

Revision of the course could be accomplished through CD-ROM or the Internet and was relatively cheap. Up to 3 hours of lecture could be stored on a single CD-ROM. The JITL offered a flexible and easy-to-use alternative for DL.

21. Davis, Diane J.; 1990; Text Comprehension: Implications for the Design of Self-Instructional Materials; in Michael G. Moore, Peter Cookson, Joe Donaldson, and B. Allen Quigley, eds; Contemporary Issues in American Distance Education; pp. 243-259; New York: Pergamon Press.

Summarizes principles from the research available to increase the effectiveness of the printed material by decreasing the cognitive load for

the reader. The following six principles were suggested to the developers of printed material:

- "Use vocabulary that was appropriate to the audience and the task at hand in order to minimize the cognitive capacity required to process the text" (p. 245).
- "Use syntactic structure that conveys the ideas at hand and effectively relates 'new' information to prior knowledge" (p. 247).
- "Facilitate the reader's ability to recognize the relationships among sentences and paragraphs" (p. 248).
- "Self-instructional text should be designed to assist the reader in identifying the most important ideas in the text" (p. 250).
- "Design text such that its organization was easy to follow and clear to the reader" (p. 253).
- "Include activities in self-instructional print materials that will assist the reader to assimilate new ideas from text, integrate those ideas with prior learning" (p. 255).

Each of the six principles was followed with suggestions for applications which makes this article worthwhile to the developers of print material for self-instruction.

22. Dean, Raymond; Biner, Paul and Coenen, Matthew; (1995). Distance Education Effectiveness: A Systems Approach to Assessing the Effectiveness of Distance Education; ED Journal; 9 (4); J-17 - J-20.

Suggests a systems model to assess the effectiveness of distance education programs. The main elements of the model were learner variables, instructor variables, presentational elements, and course content elements. The learner variables suggested for use were:

- Demographic and personality variables.
- General abilities
- Motivation factors
- Prior knowledge
- Learning history/styles
- Past scholastic achievement
- Performance skills
- Reaction to the course

The instructor variables were:

- Personality and subject-matter knowledge base
- Extent of training in teaching a teleeducation course
- Goals and objectives
- Pedagogy

The presentational elements were:

- Time
- Modalities employed
- Technologies used
- Attention/entertainment value
- Environment

The course content elements were:

- Discipline-specific concepts and material
- Learning objectives
- Type of material
- Metadisciplinary skills

The authors suggested that while final course grades as an index of achievement may not be the best measure, it was still the most easily attained measure. The researcher encouraged readers to add objective tests, simulations, and interviews to provide a validity check for the grades. The interaction of all these elements should be used in a systems evaluation of DL.

23. Dede, Chris; April, 1996; The Transformation of Distance Education to Distributed Learning; Learning and Leading in Educational Technology.

Proposes that distance education, which "replicates traditional classroom teaching across barriers of time and space," will be replaced with distributed learning which will incorporate new paradigms of thinking and learning. The author contended that the focus should not be on automating the old message but redefining the way we communicate by using the new methodologies to create new ways of communicating and educating that would be more effective. "Conventional distance education was similar to traditional classroom teaching, save that it uses technology-based delivery systems" (p. 2). To be prepared for the future, learners need a shift in instructional paradigm. This shift was possible through the technology available in the distance education world. The author listed four new forms of expression that he thought would shape this new paradigm. These were: knowledge webs, interactions in virtual worlds, experiences in synthetic environments, and sensory immersion. A discussion of each of these forms with examples were included in the article. The author concluded his article with a discussion of how these new paradigms will effect the workplace. The skills developed in DL courses were the skills that will be needed to enable students to perform in the work places of tomorrow. "Educators must help all students become adept at distanced interaction, for skills of information gathering from remote sources and of collaboration with dispersed team members are as central to the future American workplaces as learning to perform structured tasks quickly was to the industrial revolution" (p. 10).

24. Deloughry, Thomas D.; December 8, 1995. Making Connections; The Chronicle of Higher Education; A21-A24.

Discusses the consortia being formed by colleges for the purpose of distance education classes. The primary motivation was economic. Consortia were a way to share the cost for the technology and courseware for distance education. By sharing the cost and expertise, colleges were able to offer more low density classes such as less common foreign languages and advanced physics. The extended clientele that the universities were able to reach by pooling their resources could increase the revenues generated by the universities. As for-profit companies become more involved in electronic universities and are granted accreditation, the colleges and universities who do not form consortia and compete for distance students may well find themselves out of business.

25. Dereshiwsky, Dr. Mary I.; 1996. Murphy's Law (Mega) Bytes the Dust: Debunking the Myths of Teaching by Computer; ED Journal, 10 (2), J-10 - J-14.

Discusses the myths and realities of teaching a research and statistics class by computer. The course was a semester length graduate-level course. The American On-Line computer bulletin board was the primary instructional delivery medium. The lessons and completed assignments were transmitted electronically and all interaction with the instructor was through e-mail.

Myth 1: Computer courses were cold and impersonal. The students in this course enjoyed the interaction with the instructor through e-mail and felt it was more personal.

Myth 2: Computer courses were 'just a correspondence school' which won't allow for direct interaction. The interaction with the e-mail was such a success in this course that the instructor was using e-mail to advise dissertation candidates through their statistical analysis.

Myth 3: Computer courses were hard for inexperienced computer users. Not one student in this course, not even the novices, had any problems with installing and using the American On-Line software used in this course and actually encouraged students to pursue other uses for the computer.

Myth 4: Computer courses consist of 'watered-down' curricular material. For this course the lesson packets were perceived as totally equivalent. The instructor's use of the technology to bridge the material and provide continuity increased the students perception.

Myth 5: Statistics and research were traditionally tough stuff, too hard to teach successfully via computer. The students felt that the course

materials were as clear, understandable, and comparable in every way to live instruction. With the addition of the one-on-one help available from e-mail and the ability to work in teams or groups, the students had no problems with the lesson material.

26. Dillon, Connie L. 1992; The Study of Distance Education in the United States: Programs of Study and Coursework; *The American Journal of Distance Education*; 6 (2); 64 - 69.

Contains a listing of distance education programs both credit and noncredit from various universities in the US.

27. Dillon, Connie L. 1991; Instructional Strategies and Student Involvement in Distance Education: A Study of the Oklahoma Televised Instruction System; *Journal of Distance Education*; 6 (1); 28-41.

Compares the instructional strategies used by faculty for teaching a televised class to an on-campus class. A series of surveys with follow-up interviews were given to instructors who taught via the Oklahoma Televised Instruction System (TIS). This system provided one-way video and two-way audio communication between students and instructor.

Surveys were returned from 113 instructors who had taught 220 classes on TIS. The courses taught were full semester and a combination of lower and upper undergraduate courses and graduate courses. When given a list of 13 teaching strategies and asked to identify the type they used on a scale of 1 to 5, instructor centered strategies of lecture, directed questioning, and demonstration were used most often. When asked about on-campus classes, interactive strategies of discussion, group projects, and peer teaching were used significantly more than in the televised classes. In open-ended questions the faculty were asked to identify strengths and weaknesses of the system. Strengths were perceived as better access to students, a new experience for both student and instructor, and features of the media that enhance the learning experience. Weaknesses listed were technological problems, lack of face-to-face contact, requirement of a more structured presentation, and administrative support. In spite of all the problems, the faculty believed that TIS was a valuable tool for reaching distant students.

28. Distance Learning Delivery Systems; 1995; Prepared by Federal Training Network; Internet - <http://www.nmaa.org/member/ftn/delivery.html>.

Describes ways in which organizations deliver instruction to remote sites. For each of the six delivery systems discussed, the article included a description, some advantages and disadvantages, approximate costs, some examples from federal government, and some comments. The six delivery systems were: audioconference, audiographics, one-way analog

video, one-way digital video, two-way digital video, and computer-mediated communication.

29. Distance Learning Directory; Compiled by the Howard University Continuing Education Program; Internet - <http://www.con-ed.howard.edu/WebPages/dll/Dist-Lrn/dld.html>; printed from internet January 4, 1996.

Lists DL programs arranged by level and type of instruction.

30. Distance Learning: Planning Considerations and Options, 1995. University of Michigan, Information Technology Division, Office of Instructional Technology; Internet - <http://www.oit.itd.umich.edu/reports/DistanceLearn/>.

Provides a practical guide for organizations or personnel who are contemplating using DL. The guide put together by the staff at the University of Michigan. A description of the various types of DL alternatives with examples of each type and the optimal number of sites and students per site were listed. Some of the more common types were one-way, one site-to-multiple sites; two-way, site-to-site; partial two-way, multiple sites; and two-way, multiple sites. One-way, one site-to-multiple sites communicated in one direction only and delivered to all sites.

Typically this was used for motion video in a satellite-based DL network. Two-way, site-to-site was communicated in both directions simultaneously and was used for motion video and audio that was based on video-conferencing technology. Partial two-way, multiple sites was simultaneous delivery to multiple sites with two-way available from one student site at a time that was alternated at will. Two-way, multiple sites was simultaneous communication between all sites and was typically used for computer-based data in a collaborative application and may or may not involve more than one instructor. The required or acceptable level of cost was determined by examining the expected revenue, other expenses and the acceptable level of interaction for the course. The costs could range from under a hundred dollars per class-hour to over a thousand dollars per class-hour.

The differences between a traditional classroom and DL classroom included the following issues:

Issue	Traditional Classroom	DL Classroom
Faculty preparation	Planned or spontaneous	Must be planned to accommodate technology
Lecture notes	Read from, projected on overhead, or written on blackboard	Provided to students ahead of time, or prepared for transmission on appropriate media
Class materials	Handed out	Provided to students ahead of time
Preparation	Less time needed	Significantly more time needed
Classroom	Know what to expect and how to act	New environment with new rules of interaction and conduct
Time	Same time zones	May be different time zones
Interaction	In classroom, out of classroom both are easy	In classroom will depend on technology, encourage out of classroom with available technology
Assignments	No limitations	Can be limited by technology, care must be given to be creative to allow variety and full feedback

Some of the cost issues that must be considered in implementing a new DL program were technology costs both for equipment and transmission, any costs associated with course materials (postage, phone, fax, etc.), and the time faculty and staff needed to prepare for the course. In addition, the mechanisms had to be in place to handle the administrative end of the course to ensure proper credit and fee payment. This article also included guidelines for effective videoconferencing.

31. Dwyer, Frank M.; 1990; Enhancing the Effectiveness of Distance Education: A Proposed Research Agenda; in Michael G. Moore, Peter Cookson, Joe Donaldson, and B. Allen Quigley, eds; Contemporary Issues in American Distance Education; New York: Pergamon Press; 221-230.

Discusses issues that developers of DL materials need to be concerned with. These issues were how do the students perceive, assimilate, store, and retrieve information. The importance of visualization to printed and oral information was discussed in detail. However, the author cautioned that too much visualization could have the same effect as too little visualization. The costs and benefits must be carefully weighed to reach the optimum level for a course. To achieve this optimum level, Dwyer recommended a systematic evaluation approach to the development of the training materials.

This approach involved the use of the oral or printed material by itself for the control group with different levels of visualization developed for treatment groups. Making sure that all groups received the same time length for instruction and received the same tests, a comparison could

then be made for the most effective level of visualization. In this case, more might not be better.

32. Eisley, Mark E.; 1992; Guidelines for Conducting Instructional Discussions on a Computer Conference; DEOSNEWS; 2(1); 3 - 9.

Discusses the MS Degree in Instructional and Performance Technology using computer-conferencing offered at Boise State. Three types of communication architecture were described: e-mail, bulletin boards, and computer-conferencing. Strengths and weaknesses of each system were described. The author gave guidelines on how to structure the discussions through the computer to simulate classroom discussions. Two key principals were design the discussions ahead of time and manage the discussion in process. When designing the discussion, tie the discussion plans to your objectives, and structure your discussion to get your points made.

Thirteen formats were identified to help structure the discussion and keep it both informative and relevant. These 13 formats were:

- The critique (as a group point out the strengths and weaknesses of the study).
- The group report (form a restricted conference, research the topic, and report back to the whole class).
- Twenty questions (in a group interview, try to narrow down specifics about a vague statement).
- The poll (conduct a poll via e-mail with privacy ensured to express opinions about a topic).
- Timed disclosure (in a short paragraph, send a justification for your position on a topic and then do a group discussion on everyone's).
- The assigned debate (pick debate teams and have them debate a topic).
- Free association (solicit thoughts and ideas on a subject).
- The hot seat (call on a specific student to answer a question).
- The Socratic dialog (the instructor asks a question and receives one answer, then asks another with every other comment coming from the instructor).
- The shot gun (a list of topics all related to one topic are given and the students can respond to any one of them).
- Go around the circle (go around the circle discussing one topic then end).
- Guided discovery (have the class discuss the research without giving them the results until they ask the same questions).

- Blind man's bluff (propose an initial premise that is purposely misleading and student through discussion should find the misleading argument).

In conclusion, nine managing techniques were offered to help keep the discussion on course.

- Reinforce good discussion behavior.
- Request change when the discussion behavior is poor.
- Spur participation by direct request.
- Move misplaced content.
- Vary participation by private communication with those overly outspoken or underly outspoken.
- Have a student lead the discussion on occasion.
- Do occasional summaries of the discussion.
- Do not let the discussion go off on a tangent, but leave the option open for people to discuss those topics off-line.
- End the discussions decisively.

33. Esteban, Manuel A. and Meuter, Ralph; 1996. California State Chico: A Traditional University and Pioneering Leader in Distance Education; ED Journal; 10 (2); J-4 - J-7.

Presents a history of the development of the distance education program which has evolved from live, interactive television program to live interactive satellite technology and discusses the problems encountered in expanding the program throughout California's university system.

The problems for California State University (CSU)/Chico were the same problems any academic institution will experience in changing to a new system. The president of an university could not order the faculty to integrate technology in their classes or expand the concept of a physical classroom to a virtual classroom. The faculty were afraid that technology might ultimately mean their jobs. Some questions that arose were:

- Who owned the taped sessions of the course?
- How were students at distance sites factored into the teaching load?
- Did the faculty get paid for extra work?
- Could the university be replaced with television and computer moguls producing low cost, on-demand education?

The opportunities made available through DL to both students and teachers helped to overcome some of the resistance. Because the university provided degree programs to major companies at their

worksite, the faculty had consultation opportunities and the students had intern opportunities.

34. Fellers, Jack W. And Moon, Donald K.; 1995; Distance Education in the Future: Exploring the Application of Distributed Group Support Systems; Group Decision and Negotiation; 4 (3); 273-286.

Discusses the use of distributed group support systems (DGSS) in a distance education environment. Group support systems (GSS) technology referred to a local system of microcomputers operating on a local area network. DGSS expanded this concept to include networks between cities or countries. The use of DGSS in distance education could greatly enhance the interactivity between instructor and students and between students and students. The GSS was designed around a toolbox approach. There were multiple software packages linked together so the output from one package could be input to another. These tools allowed the students to communicate anonymously and simultaneously. The ideas, comments, and evaluations from the students or instructors were stored and displayed. Through the use of the tools, the comments could be sorted and entered into appropriate spreadsheet format for analyzing. The major advantage that DGSS could bring to the distance education environment would be the ability for students to interact simultaneously by computer entry instead of waiting turns for an audio system. Students that were reluctant to appear on camera or speak aloud would have greater freedom to express their ideas. At the same time, those questions, answers, and comments were stored and could be used as class notes to study. Group projects and study groups could also be facilitated by the use of DGSS.

35. Fetterman, Harry E.; 1996. Videoconferencing Training: A Practitioner's Guide to Course Development, Preparation and Delivery; ED Journal; 10 (3); 9-11.

Provides guidelines for course development, preparation and delivery for videoconferencing DL. The guidelines were practical in nature. These included 13 ways to make instructional material more effective, ways to overcome the slower pace of video conferencing, 10 suggestions for conducting discussion periods, and 5 points to remember on course delivery. The 13 tips to make your instructional material more effective were:

- Think visually, how will this look and what does it contribute to the class.
- Focus on the message not the media.
- Use at least a 24-point font in a plain format.
- Use a landscape format with a width to height ratio of 3:2.

- Use large margins to ensure the full screen will be transmitted.
- Use titles and heading of five words or less.
- Text screen should have not more than six lines of text with no more than six words per line.
- Line spacing should be uniform to ensure readability.
- Ensure screen transitions work on the video media used at the sites.
- Colors should be simple with strong contrasts.
- A computer generated presentation should contain not more than five different types of formats.
- Flip charts should be used rather than white boards for video conferencing.
- Basic rule was keep it clear, clean, concise, and consistent.

Some ways to over come the inherent slower pace of DL were to develop sections of instruction to cover specific topics and include small group activities, questioning, lecture, discussion, and assignments for each section. Each module of the course should be designed to fit the given time limits. Preparing questions to assess students prior knowledge of the subject may allow the instructor to skip or condense some sections of the material.

The 10 suggestions for conducting discussions were:

- Summarize following each discussion.
- Personalize the discussion by addressing students by name.
- Ensure the question or discussion can be heard by all sites.
- The instructor should maintain eye contact with the camera.
- Don't rush to fill dead time while awaiting questions or answers.
- Be enthusiastic and interested.
- Encourage all students to participate.
- Redirect questions from one site to students at another site.
- The instructor should include individuals from all sites in his questions.
- The instructor should address each site individually when asking questions such as "Are there any more questions?."

The instructor must have adequate preparation time and ensure that all course materials were received by the students. Hand-outs delivered ahead of time ensure the students can see charts, graphs, etc., that might be essential to the course. Course delivery could be enhanced by a successful first class session. Five points to remember for the first class were for the instructor to introduce himself and the students at each site, review the course agenda, ensure that the students know how to use any

technology required, inform students of the interaction required, and the instructor should conduct an introductory activity to allow students hands-on experience with the technology.

36. Fletcher, J. D.; 1990. Effectiveness and Cost of Interactive Videodisk Instruction in Defense Training and Education; Paper prepared for Institute for Defense Analysis.

Presents a meta-analysis of 47 studies done from 1959 to 1990 on the use of interactive videodisk technology in training and education as it pertains to effectiveness, cost, cost-effectiveness, time on task, and retention. The analysis compared the average effect size for interactive videodisk when compared with conventional approaches to instruction.

The analysis produced the following results for effectiveness:

- Interactive videodisk was successfully used to teach.
- Interactive videodisk was more effective than conventional approaches.
- Interactive videodisk instruction was more effective in military training.
- Interactive videodisk was more effective for instruction in higher education.
- Interactive videodisk was equally effective for both knowledge and performance outcomes.
- More interactive features produced more effective instruction.
- Stand-alone simulation were more effective when used in a directed, tutorial approach than by themselves.
- Achievement in the videodisk groups was less variable and more equitably spread than in conventional instruction
- Interactive videodisk instruction produced higher effect sizes than CBI.

Costs were less for interactive videodisk than conventional in the 13 studies that examined costs. Cost-effectiveness was not done in any of the studies in a systematic manner that measured both costs and performance outcomes. Interactive videodisk might increase time on task but no conclusive evidence was found. Based on the studies examined in this analysis, there was little evidence to show that interactive videodisk instruction would have an effect on retention. The author suggested that interactive videodisk should be used in military training.

37. Garg, Rajiv; 1996. Distance Learning: Interactive Video Teletraining as an Emerging Technology; ED Journal; 10(3); 12 - 15.

Provides a description of interactive video teletraining (IVT) architecture and a brief explanation of how it works. In addition, some findings and lessons learned from the Federal Aviation Administration (FAA) demonstration IVT pilot courses were discussed. The main findings were: IVT was an effective medium for training and testing a large number of students; students viewed the IVT experience favorably; instructor/student and student/student interaction was sophisticated and creative; and the reported productivity gains averaged between \$1,305 and \$6,353 per student.

38. Garrison, D. R.; 1990; An Analysis and Evaluation of Audioteleconferencing to Facilitate Education at a Distance; *The American Journal of Distance Education*; 4 (3), 13-23.

States that the quality and integrity of the educational process is dependent upon consistent two-way communication. The student must have access to the instructor and other students to properly process and apply the information. The delivery of course content in a print format was insufficient because of the lack of interaction. Garrison presented the results from a survey given to students in wide range of courses both at the graduate and undergraduate level from the spring of 1986 to the fall of 1988. Of the 1059 students who completed the courses, 522 completed and returned the survey. There were 34 courses offered during this period and some of the students from each course responded.

Eighty-seven percent of the students felt that the sound quality was at least acceptable. When asked if they would recommend this style of instruction to others, 94 percent responded positively. The students felt that the level of interactivity was adequate and only a few contacted the instructor other than regular course time. This may have been a reflection of the difficulty of reaching the professors and not a reflection of the need because 62 percent felt that it was essential to communicate with the instructor between teleconferencing sessions. Audio teleconferencing satisfied the interaction needs of the student while still being a relatively inexpensive form of delivery when compared to video.

39. Golas, Katherine C. and Montag, Bruce C.; 1995; The New Media - Interactive 3D; Paper presented at 17th Interservice/Industry Training Systems and Education Conference, Albuquerque, NM.

Discusses the application of 3D media. Interactive courseware (ICW) has evolved to another level with the addition of interactive 3D. Although the price of the technology to develop and implement the 3D technology was coming down, the developer must still make a careful decision about including 3D in their courseware. The authors suggest the following applications for 3D media:

1. "The training program or courseware must provide a high degree of realism to help personnel learn their jobs without putting them or their high-priced equipment at risk.
2. The tasks to be trained were of such a nature and complexity that the training program or courseware must incorporate dynamic spatial scenarios that were interactive.
3. Training must be developed for an emerging system and delivered prior to the new equipment coming on line.
4. It was impossible to capture an object or scene for an ICW multimedia presentation on videotape or film.
5. There was no other option for training except simulation, and the personnel being trained only get one chance to perform the task to 100 percent accuracy" (p. 3).

Specific details about the hardware and software needed for this technology including approximate costs were included in the article. The training effectiveness of 3D interactive simulation has been demonstrated in various NASA training programs for the astronauts, a major US automotive maker, and by defense contractors. Three-dimensional graphics have resulted in faster knowledge acquisition and conceptual understanding than traditional media. The need for this level of fidelity must be carefully weighed by the developer with the cost and difficulty of producing 3D interactive simulations.

40. Guckenberger, Dutch & Liz; 1995; Integration of Today's Interactive Television & DIS Into Tomorrow's Educational Solutions; Paper presented at 17th Interservice/Industry Training Systems and Education Conference, Albuquerque, NM.

Discusses using distributed interactive simulation in combination with interactive television to deliver DL, including hands-on user interaction and remote simulator training.

41. Hapeshi, Kevin and Jones, Dylan; 1992; Interactive Multimedia for Instruction: A Cognitive Analysis of the Role of Audition and Vision; International Journal of Human-Computer Interaction; 4(1); 79-99.

Presents guidelines to aide both training developers and users. The authors cautioned to remember that the purpose was to educate and not entertain. Training materials have been developed that were very entertaining but have lost the message in the process. References to research that supported the guidelines were included in the article. After a careful discussion of the research and methods of learning, the authors recommended the following guidelines:

- "Short lists are best presented in auditory form; longer ones in visual form.

- Where detailed prose is to be presented, it should be in the form of text that can be reviewed. Short summaries of this can be presented in auditory form.
- Speech information should be used sparingly; expert summaries are better for learning than long passages if the auditory channel is used.
- Simultaneous speech and visual presentation should be avoided if the visual event or display must itself be interpreted in verbal form (verbal recoding).
- If a number of lists or facts are to be learned in a session; alternating mode of presentation reduces forgetting due to interference.
- Sounds (music and special effects) not relevant to the instructional theme can be distracting and should be avoided.
- Use speech input to encourage vocalizing of material to be learned; this will enhance recall.
- Where possible, keep the visual and auditory messages independent; do not assume these will always be presented together" (p. 96-97).

42. Hansen, Nancy; 1995; Teaching Graduate-Level Seminars Using Electronic Mail: Creative Distance Education; DEOSNEWS; 5 (1); 1-7.

Discusses using CMC to teach graduate-level seminar classes in clinical psychology or human organizational development available through Fielding Institute. Students contracted with the instructor to either do classes on an independent study basis or join fellow students with a joint interest in a topic. These on-line seminars were limited to eight students with required readings being done before the seminar starts. Extra care was required in designing collaborative learning environments, in managing the large amount of postings by articulate graduate students, and maintaining an open environment for expressing divergent opinions.

43. Heinlein, LTC Robert A.; 1995; Synthetic Environment for Education: A Vision for the Future; Paper presented at 17th Interservice/Industry Training Systems and Education Conference.

Proposes a synthetic environment for education (SEE) based on the current development of the distributed simulation for military use. The discussion included a framework, description, and some examples of how the SEE might be operational in the classroom. The SEE as the author envisioned was the coordination platform for an integrated curriculum. "As a coordination platform for an integrated curriculum, the SEE can serve as an effective and flexible tool for discussion, demonstration, observation, and experimentation for any teacher, any students and any discipline." That environment would include an audiovisual system,

experimental interface tools, teacher support system, communication network interface, simulation environment management system, and a student learning support system. The author concluded with a proposal for government, industry, academia, and public education to work together to make this concept a reality.

44. Hedegaard, Teri; 1996; Computer-Mediated On-Line Education: Lessons Learned by the University of Phoenix; ED Journal; 10 (2); J-1 - J-3.

Discusses an on-line computer-mediated degree program that has been used at the University of Phoenix for 8 years. It had been a success without the audio and video capabilities of some of the newer systems. The interactions established for the courses were interactive but asynchronous. This allowed the students to carefully formulate and review their responses. In addition, CMC fostered a democratic atmosphere where student input was judged on its own merit and not by superficial details. The author credited the success of the program to a careful match of the curriculum design to the media, a highly structured program, clear expectations established for the students, frequent contact between students and faculty, stringent faculty selection and training, and designing a curriculum with clearly established goals and outcomes.

45. Hillman, Daniel C. A., Willis Deborah J., and Gunawardena, Charlotte N.; 1994; Learner-Interface Interaction in Distance Education: An Extension of Contemporary Models and Strategies for Practitioners; The American Journal of Distance Education; 8 (2), 30-42.

Discusses the importance of the learner-interface interaction and how it effects the learning process. Students involved in DL not only have to learn course content but must also learn how to interface with the DL technology. Depending on the experience of the student with new technologies and the ease of use, this could be a minor to a considerable barrier to DL. The authors suggested three methods to deal with the problem: (1) in-class exercises, (2) orientation sessions, and (3) technology credit course. Each of the three had some drawbacks. The orientation session was used for a graduate-level course taught at the University of New Mexico using Worldlinx audiographics system and electronic mail. Some learners preferred exercises that were course related and some preferred a more relaxed atmosphere. This was an issue that must be addressed in any DL course.

46. Hiltz, Starr Roxanne; 1993; Correlates of Learning in a Virtual Classroom; International Journal Man-Machine Studies; 39; 71-98.

Discusses research questions on the Virtual Classroom (VC). "The Virtual Classroom® consisted of software enhancements to the basic capabilities of a CMC system in order to support collaborative learning"

(p. 71). (The VC is copyrighted software and a registered trademark of the New Jersey Institute of Technology.) The purpose of this study was to answer two key research questions: (1) Did the VC deliver education that achieved the same outcomes as traditional classroom training? and (2) Were there any variables that affected the outcome either positively or negatively? The authors emphasized the design constraints that applied to any computer-mediated conferencing software for distance learners. These constraints included: the ability to operate on a wide variety of microcomputers and terminals; a reasonable response rate at 1200 baud; and attention must be made to avoiding information overload and cognitive confusion.

Five courses provided the primary input for the study. These courses were Introduction to Sociology, Introduction to Computer Science, a statistics course for freshman, an upper-level statistics course for engineers, and an upper-level course in management. All, but the management course, were offered both face-to-face and by the VC. The management course was offered face-to-face or a combination of face-to-face and the VC. Students were allowed to select their mode of instruction. The nature of assignments differed between the two modes of delivery. The VC provided an opportunity for collaborative learning and the assignments were constructed to take advantage of that feature.

Four other mixed format courses with no traditional counterpart also provided some data for the study. These four courses were a writing course, organizational communication, anthropology, and business French. Two additional courses that had no traditional counterpart were added in a third expansion, graduate-level course in media studies and a graduate-level course for teachers. These expansions to the original design were made to cover a wider range of courses and to increase the sample size.

The data were analyzed with a wide variety of methodologies and tools. The data supported the conclusion that the VC was a viable alternative for college-level learning. In the first five courses that had a traditional class to compare, there were no significant differences that favored face-to-face learning. There was one course in computer science that the VC grades were better. The majority of students thought VC improved the overall quality of the learning experience, but there was variation in this response depending on the class. Those students who experienced high levels of communication with other students and participated in collaborative learning were more likely to judge VC favorably. Higher ability students as measured by scholastic aptitude test (SAT) scores were more likely to receive high grades and give a more favorable report about VC. A successful outcome in the VC environment depended on the student and the instructor maximizing the opportunities presented by the

media, student motivation for self-starting, and adequate access to the necessary equipment.

47. Howard, F. S.; 1992; Distributed Training Pilot - MOS 75B Distributed Training Course Training Effectiveness Analysis; TRAC-WSMR-TEA-92-031; US Army TRADOC Analysis Center-White Sands Missile Range.

Provides an evaluation of the training effectiveness of using CBI in a resident environment. The study simulated DL in the aspect that the instructor did not do any instruction but served as a facilitator for the course. The course selected for this study was the MOS 75B10, Personnel Administration Specialist, an advanced individual training (AIT) course for initial MOS award. All of the course was converted to CBI except for the field exercises. The course length minus the field exercise was 223 hours which equates to 8 weeks of instruction. There were five groups in the study which included two classes of CBI students (60), two groups of conventional students (50), and one class that was added to the study which combined both conventional and CBI (27) for a total sample size of 137 soldiers. Since there was no end-of-course exam, one was developed by the study analyst with expert help from the Adjutant General school. The same written exam was given to all students before instruction started and a different version after instruction was completed. There were no differences in the groups on the pretest. Regardless of how the students were trained, there were no differences on the posttest. The big difference was the time saved by the CBI classes. On the average, CBI students finished the course in 2 weeks less time. The amount of prior computer experience had no effect on course performance.

48. Howard Fay S.; Henry, Joyce B.; Kinney, Patricia; and Dannhaus, Dale; 1991; Distributed Training Strategy Training Effectiveness Analysis MOS 63W Desktop Video Pilot Study; TRAC-WSMR-TEA-91-023; US Army TRADOC Analysis Center-White Sands Missile Range.

Discusses the use of video training tapes to train MOS 63W wheeled vehicle mechanics. This study had a three fold purpose: (1) to assess the process of developing and producing video training tapes by in-house personnel using desktop video production capabilities versus professional development; (2) to assess the effectiveness of using these tapes for sustainment training; and (3) using the tapes for initial training. Measures used in this study included demographic data, pretest, posttest, student surveys, instructor interviews, and direct observations and interviews by the study team.

There were 6 video tapes produced from AIT course number 610 for MOS 63W wheeled vehicle repairers. The sample size included 6 individuals trained to produce the tapes, 17 soldiers in the sustainment phase, 55 soldiers in the video trained for initial training, and 48 in the control

group for initial training. Due to a limited number of students for sustainment training, there was no control group available for this portion of training. In addition, the sustainment group watched the video on the shop floor and were allowed to stop, rewind, and rewatch as needed. A different set of students watched each of the three tapes used. For the initial training phase there was both an experimental and a control group and the same group of students watched all six tapes.

The results were that the video training tapes produced were acceptable, video-trained soldiers performed at least as well as traditional training and in some cases significantly better, and soldiers thought the video tapes were good especially if allowed to rewind and review the tapes. The video tapes replaced 1 hour of instruction which reduced instruction time by about one-third. The costs of the desktop produced videos were about half the costs of commercially produced videos once sunk costs were recouped.

49. Howard, Fay S. and Nantz, Samuel; 1994; Computer-Assisted Instruction (CAI) Study; US Army TRADOC Analysis Center-White Sands Missile Range.

Investigates the efficacy of using computer-assisted instruction (CAI) for training commercial accounts personnel for the US Army, including both training effectiveness and resource implications. For the most part, commercial accounts work was done by department of the Army civilian employees with a few military personnel. Five groups were identified for the study: CAI used at the school house, CAI at a remote site, traditional at the schoolhouse, traditional at a remote site, and CAI used at an outside the continental US (OCONUS) site. The study sample consisted of 100 civilians and 10 military. No differences were found on preinstruction measures between the resident and remote sites, therefore, two CAI groups were combined and the two traditional groups were combined. Comparisons were done between CAI and traditional instruction and between CAI CONUS and CAI OCONUS. Results from two tests, the course test and a posttest developed by the study analysts as an independent measure, were used to measure performance. There were no differences found between any of the groups on either test. The main complaint that the students had about CAI was a perceived lack of feedback on the tests, but this did not effect performance. The resource analysis was done on the assumption that the CAI course would replace traditional training for commercial accounts personnel. The savings were based on travel costs (temporary duty) for both students and instructors and estimated to be one million dollars over a 10-year period.

50. Hudson, Rhett; 1996; DT-5: Demonstration Projects Distance Learning; Internet <http://www.visc.vt.edu/succeed/distance.html>.

Provides an overview of the demonstration projects done by Deliverable Team #5 (DT-5) for the SUCCEED coalition. As part of the charter, DT-5 was charged with demonstrating electronic connectivity solutions for DL. Three projects were described:

- Hudson, Rhett, and Kies, Jonathan K.; 1996; DT-5: Demonstration Project Shared Lectures over the multicast backBONE (MBONE). The MBONE was constructed on top of the internet and provided the capability for one computer to relay the same information to many computers. Using this system, the demonstration project had two trials. In both trials a professor delivered a lecture at his college and was broadcast to other sites. A quiz and a questionnaire was given after both lectures. There was no difference in student performance at any site and student satisfaction with the experience was similar.
- Hudson, Rhett; 1996; DT-5: Demonstration Projects Guest Lecturer Using ProShare. ProShare was a relatively low-cost desktop videoconferencing system that used Integrated Services Digital Network (ISDN) lines to transfer audio, video, and data. The goal of this project was to demonstrate that this system could be used to provide outside lecturers to a class. An expert on the desktop video conference marketplace at Intel delivered a lecture to a Virginia Tech class via ProShare. A projection system was used to display the video conference on a large screen and CallPort was used as the microphone system. Because of the need for multiple microphones, the echo cancellation feature of CallPort had to be disabled for this demonstration. This meant they had to manually mute one side of the conference or the other. The cost of the presentation was low about \$4000 for the equipment and the transmission costs. The majority of the students thought the lecture was effective.
- Hewitt, Kathy L.; 1996; DT-5: Demonstration Projects Interactive Seminar using MBONE. This project was a demonstration of the interactive capability of the MBONE system to conduct seminars between North Carolina State University (NCSU) and North Carolina Agriculture and Technical (NCA&T) State University. During the Spring 1995 semester, seven seminars were conducted over the MBONE using video, audio and a white board for slide presentation. A questionnaire was sent to all participants and everyone who responded rated the media as acceptable to excellent. The video component was rated as not as essential to the seminar as the audio and white board.

51. Hrydziszko, Janet; 1996; Ford Practices Continuous Improvement in Training; ED Journal; 10(5); J-12 - J-13.

Discusses the Ford Motor Company satellite network (FORDSTAR) that provides a direct one-way video, two-way audio hookup with Ford retail dealers and regional centers. The interaction between student and instructor was done with OTRS technology. This technology improved the acceptance level of the DL among the participating dealerships and their

employees. The number of people able to be trained before FORDSTAR was 14,000 and the anticipated total with FORDSTAR was 75,000. The developers of the training for Ford found that a team approach to developing training was the best. They used a nonlinear model for the development and found that evaluation of the training early in the design process saved time and money. Also, continuous improvement in the product had increased the participation rate.

52. Jinkerson, Lorana and Satterlund, Scott; 1996; Survey of Distance Learning Students and Teachers; ED Journal; 10 (5); J-5 - J-7.

Presents results from a survey of high school teachers and students to evaluate their perceptions of the DL experience. Nine teachers and 115 students responded to the survey. All of the respondents were involved with courses that used interactive two-way video and audio. The survey used a Likert scale. In general the study concluded:

- "Students and teachers were, for the most part, very satisfied with their distance learning experiences.
- Students and teachers indicated that the educational opportunities delivered through DL would otherwise not be available.
- Students were interested in other students' ideas and experiences bridging understanding of other communities.
- DL increases students' curiosity of educational technologies and the future of communications.
- Students and teachers were fascinated with information and communications technology processes and this interest may transfer to other activities.
- Distance teaching demanded new skills for teachers to effectively produce instruction and facilitate interaction" (p. J-7).

53. Jones, Judy L. and Simonson, Michael; 1996; Distance Education: A Cost Analysis Final Report; Internet http://www.ipv.org/FINELINK/resources/full_text/13-full-5.htm.

Presents a cost comparison of three types of transmission technology for DL. All three systems provided two-way video and two-way audio, but one of the systems used a computer device to compress the signal. The three systems were fiber optics, microwave, and compressed video.

Transmission costs for varying distances were compared. The costs for equipping and installing a DL classroom were also described in the study. The conclusions reached in the study were that for shorter distances, if full motion video was essential, microwave was the most viable solution. For longer distances, compressed video was the least expensive to install and was a viable alternative no matter what the distance. If there was a fiber optic system already in place that could be leased, then it should be considered. The major costs for all three systems were for system

consulting and design; materials, construction, and installation; terminal end point connections; and maintenance costs. The most expensive DL media was microwave with the cost increasing proportionate to the distance. The costs of equipping and installing a two-way interactive classroom was approximately \$30,000, but equipment was easily added or eliminated to fit budget needs. Surprisingly, it was 30 to 70 percent cheaper to buy individual items to equip the classroom than to buy packages of complete systems. "Two-way, interactive television systems were expensive, complex and time-consuming to design, construct, and maintain" (p. 24). On the plus side, the operation and maintenance was neither complex nor costly. In the long run, the success of any delivery system depended on the quality of the content and not the choice of equipment.

54. Kendall, Janet Ross and Oaks, Muriel; 1992; Evaluation of Perceived Teaching Effectiveness: Course Delivery Via Interactive Video Technology Versus Traditional Classroom Methods; DEOSNEWS, 2 (5); 1-8.

Compares the perceived effectiveness and satisfaction of university faculty teaching in traditional and distance education courses. The courses were undergraduate and graduate college courses from a variety of disciplines and were one semester in duration. Survey results were collected for 3 semesters from a total of 91 instructors and results were used to design effective faculty development programs. The results revealed that while faculty had made adaptations to their delivery, audio-visual aids, and interaction with students; they had not made changes to syllabus, course organization, assignments, or exams. Over half the faculty selected felt that they could not do as well on hands-on experience, encouraging participation in class discussion, and actively involving the students as they could in a traditional class. The major concern that the faculty expressed was the lack of interaction with their students. The university was designing a course for their faculty to teach skills that may lessen this impact.

55. Kulik, Chen-Lin C. and Kulik, James A.; 1991; Effectiveness of Computer-Based Instruction: An Updated Analysis; Computers in Human Behavior; Vol 7; 75-94.

Presents a meta-analysis of the findings from 254 controlled evaluation studies of the differences in performance between groups that used CBI and control groups that did not. The studies for this analysis had to meet four criteria:

- The studies had to be conducted in an actual classroom involving real teaching;
- The outcome measures had to be quantitative and measured in the same manner for both the experimental and control groups;

- The studies had to be free of methodological flaws; and
- The studies had to be available from university or college libraries by interlibrary loan.

Methodological flaws were defined as, "(a) substantial differences in aptitude of treatment and control groups, (b) unfair "teaching" of the criterion test to one of the comparison groups, and (c) differential rates of subject attrition from the groups being compared." Outcome measures were achievement examinations and were expressed as the common measure of effect sizes for statistical analysis.

A total of 248 of the 254 studies reported results from an examination given at the end of instruction to both the experimental and control groups. In 81 percent (202/248) of these studies CBI students had a higher examination grade than the conventionally taught class. In the other 19 percent (46/248), the conventionally taught students had the higher grade. These differences were significant in 100 of the studies. Out of these 100, 94 of the significant studies favored CBI. The effect size analysis results were that in the 248 studies the CBI degree of benefit was 0.30. This means that the average student in the CBI class would perform at the 66th percentile and the average student in the conventional class would perform at the 50th percentile.

There was an interaction between duration of the course and CBI. The average effect size for the shorter courses (4 weeks or less) was significantly higher than the longer courses. The average effect size for the short courses was 0.42 and for the longer courses was 0.26. This difference was significant at both precollege and post secondary levels.

Twenty-three of the studies compared course completion rates. In 13 of these studies, conventional groups had a higher completion rate than the CBI groups. Thirty-two postsecondary studies compared instructional time for CBI versus conventional. The average savings in time for CBI were two-thirds of the time for the conventional training. There was no analysis done on cost effectiveness of CBI in this study. Overall, CBI produced better or the same quality of instruction in reduced time.

56. Kulik, James A.; 1994; Meta-Analytic Studies of Findings on Computer-Based Instruction; in Eva L. Baker, and Harold F. O'Neil Jr. (eds) Technology Assessment In Education and Training; pp. 9-33; Hillsdale, NJ: Lawrence Erlbaum Associates; 9-38.

Examines CBI in a variety of ways. First, the author summarized major points from 12 meta-analyses. These points were:

- Students generally learned more when they receive CBI.
- Students learned in less time with CBI.

- Students generally liked classes more with CBI.
- Students developed more positive attitudes toward computers.
- Computers did not, however, have positive effects in every area in which they were studied.

In an attempt to sort out what approaches work better for CBI than others, Kulik examined 97 studies carried out in elementary and high schools. He divided the studies into three levels: level 1 has loosely defined innovations and fuzzy models for instructional practice; level 2 innovations were more clearly defined but implemented in a variety of ways; and level 3 innovations included common instructional materials and training procedures. The conclusion from the level 1 analysis was that while the effects of CBI were generally positive, they were not totally predictable.

The level 2 analysis divided the studies into three categories: tutoring, Logo, and other uses. For tutoring, CBI produces better than average results. Logo had conflicting results and other uses also had conflicting results.

For the level 3 analysis only one program met the criteria and that was the Stanford-CCC program which has been evaluated in almost 2 dozen carefully controlled experiments over the past 20 years. Schools using the Stanford-CCC can expect an average gain of 1.4 years in performance. The overall finding was that programs of CBI have a positive effect on student learning.

57. Lehman, Captain Linda A. and Kinney, Patricia A.; 1992; Distance Learning Pilot: Video Teletraining Reserve Component (VTT-RC) Training Effectiveness Analysis (TEA); TRAC-WSMR-TEA-92-015; US Army TRADOC Analysis Center-White Sands Missile Range.

Investigates using VTT to provide the Basic Noncommissioned Officers Course (BNCOC) common leader training for the Reserve component. The sample consisted of 186 Kentucky National Guard students in five different locations. The training occurred 1 weekend a month for a period of 3 to 4 consecutive months with each student receiving 48 hours of instruction for 4 of the groups and 1 group received all 48 hours of the training in 7 consecutive days. Five groups were compared: (1) one way VTT using reconfigured materials; (2) two-way VTT using reconfigured materials; (3) traditional training using traditional materials; (4) traditional training using reconfigured materials; and (5) one-way VTT using reconfigured materials taught for 7 consecutive days. The data collection measures were demographic data, pretest, posttest, retention tests, student surveys, instructor surveys, and taped sessions of the classes. Using posttest scores as the outcome measure, the results

showed that the one-way VTT group scored significantly higher than both the two-way VTT and the traditional nonreconfigured groups and that the traditional reconfigured groups scored significantly higher than the traditional nonreconfigured group and the two-way VTT group. Both the instructors and the students rated the VTT instruction favorably.

Information on equipment reliability was obtained from observations of the taped classes. Problems with the VTT equipment occurred on the average of three times per hour. These problems ranged from poor audio to the complete loss of audio and video. The important lessons learned from the tapes were technical support must be available for the VTT classes, the site facilitator had to teach the classes when the equipment did not work, the reconfigured materials provided more information than the nonreconfigured materials, and the instructors did not seem to modify their behavior for the VTT classes.

58. Leonard, William H.; 1992; A Comparison of Student Performance Following Instruction by Interactive Videodisk Versus Conventional Laboratory; *Journal of Research in Science Teaching*; 29 (1); 93-102.

Compares interactive computer/videodisk instruction with the conventional laboratory instruction for learning biology concepts and science process skills. Students at a large midwestern university participated in the study. Two labs were used, one on respiration and one on climate and life. There were 70 students who participated in the interactive labs and 72 who participated in the conventional labs. Outcomes were measured by laboratory quizzes, laboratory reports, final exams, and time to complete the labs. There were no significant differences between the two groups on their scores, but the interactive group completed the labs in approximately one-half the time of conventional labs. Time savings were attributed to the fact that waiting time for effects was artificially shortened on the videodisk and data were easier to access in the climate and life lab. Students enjoyed the videodisk labs and appreciated the time savings.

59. Lewis, David; 1995; A Perspective on Distance Learning: Thoughts From the Bleeding Edge; *ED Journal*; 9 (4); J-9 - J-11.

Discusses HP DL initiative. The company had a need to train all the engineers on a new Reduced Instruction Set Computer (RISC) chip. It would have taken over a year and \$7 million to train everyone by conventional means. For an initial investment of \$1.5 million, HP was able to set up an interactive, one-way video, two-way audio network and delivered the training worldwide in less than 4 weeks. Some lessons learned were included in the article.

60. Litton-FiberCom Distance Learning Application; 1996; Internet
<http://www.fibercom.com/distlrng.html>.

Discusses DL as one of the key applications driving the development of the National Information Infrastructure (NII) or information superhighway. DL minimized some of the limitations of the traditional classroom approach and made an education possible to more people. ATM made possible the transporting of all data types over one line. Using fiber optic cable, it was possible to digitally transfer all forms of data: voice, video, text, and image concurrently. A DL system using ATM needed several elements. The ATM switch directed traffic flow between all sites. The video codec digitized the video signal so that it could be transmitted over phone lines. A cell adaptation multiplexer (CAM) manufactured by Litton-FiberCom served two functions in an ATM network. These two functions were multiplexing and cell adaptation. Multiplexing was the ability to accept multiple signals from various types of devices and combine them for concurrent transmission over a fiber optic cable. Cell adaptation was the conversion of signal into a format for transmission over an ATM network. A software package was required to control and schedule the DL session with all of the sites. The final piece of this system was a cable plant interconnecting the various remote sites. Some options for this cable plant were contracting with the local cable authorized television (CATV) provider or the local power company to install a fiber optic system or lease fibers from the local telephone company. Unlike many other systems this system was available and useable today.

61. Lovell, Kathryn, Parkhurst, Perrin E., Sprafka, Sarah A., Hodgins, Mark W., and Bean, Patricia; 1993; Quantitative and Qualitative Evaluation of Interactive Videodisk Instructional Modules in Preclinical Neuropathology Education; *Teaching and Learning in Medicine*, 5 (1), 3-9.

Discusses the introduction of interactive videodisk instruction (IVI) into the curriculum of Michigan State University College of Osteopathic Medicine (COM) and College of Human Medicine (CHM) to increase the active role of the student in the education process, provide teaching methods for independent learners, and increase the use of computer technology. IVI, as defined in this article "is the use of a CBI program that accesses visual images stored on a videodisk, in an order controlled by the learner." Ten IVI modules were developed on neuropathology topics and incorporated into three curricular formats. In COM, neuropathology was taught within a systems curriculum. During the fall of 1989, the students were awarded extra credit points for viewing and evaluating the IVI modules. During the fall of 1990, 3 of the 10 modules were required and the others were optional. Track I of CHM was taught in discipline-based courses. Four of the IVI modules were required and the rest were optional. Track II students were taught in a problem-solving based, independent-study curriculum. Five of the 10 modules were on the list of required course materials.

Data collection spanned the period from fall of 1989 to fall of 1990 and the sample was 340 medical students. Data collection instruments were a module specific evaluation, student information form, student tracking system, and focus group evaluation. The focus group evaluations were three voluntary meetings in which students were asked questions about "(a) hardware, (b) utility of IVI modules to achieve levels of mastery, (c) appropriateness of module content, (d) organizational factors, (e) motivational factors, and (f) self-testing components within the module." The results from the module-specific evaluation form showed no significant differences in the three groups of students (COM 1990, CHM Track I and CHM Track II) so the responses were pooled for each question. All aspects of the modules were rated as valuable in helping to master the material.

The open-ended comments were positive and students agreed strongly that they would recommend the modules to other students. The student information form was optional and only 47 students responded. Previous computer experience was distributed evenly, students who used the modules in small group study thought the interaction was beneficial, and students liked the option of leaving a comment. Students would prefer more of the lecture be replaced with CBI. Even though most of the modules were not required for any of the groups, all of the modules were used by most of the students. The time spent on the module depended more on the amount of content in the module rather than if it was required or not.

The pretest and posttest were not required for the modules, but the students who used them improved their scores. On the pretest 30 percent of the students scored more than 80 percent and on the posttest 69 percent scored more than 80 percent. The results from the student focus groups were that the equipment was easy to use, modules were best suited for acquiring basic concepts and practicing with case studies, the glossary and visual ability to compare normal and abnormal images were helpful, and the IVI teaching modules were well organized. In addition, the students thought requiring certain modules was a good strategy to get the students to try the modules and find out how much they helped and they liked the idea of self-test. The study concluded that the use of the IVI modules was successful and achieved the objectives of the program.

62. Malloy, William L. and Perry, Nancy N., 1991; A Navy Video Teletraining Project: Lessons Learned; *The American Journal of Distance Education*; 5 (3); 40-50.

Discusses the lessons learned by the US Navy in developing an overall VTT implementation plan. Policy concerns, instructional matters, and management issues were the prime focus of the authors. An interdisciplinary team was required with players from the different

organizations involved, but final decisions were always with the training community. The architecture selected for the Navy was a VTT system which included secure digitized two-way video and audio, for teaching formal Navy courses in designated areas of specialization. The Navy found few rigorous assessments of earlier efforts to guide them in their choice of systems. Initial experience with the Navy's prototype system confirmed literature findings that the retraining of instructors for the VTT role and modifications of the course's graphic materials to match the delivery system were both critical for the success of the program. A discussion of the various components of the systems and the reason for their selection was also included in the article with suggestions for both the military and civilian communities.

63. Martin, Barbara L. and Bramble, William J.; 1996; Designing Effective Video Teletraining Instruction: The Florida Teletraining Project; Educational Technology Research and Development; 44 (1); 85-99.

Discusses various military courses that were taught to Reserve Components soldiers using community college personnel via the US Army's teletraining network (TNET). TNET was a two-way interactive network. The courses included MOS producing courses from the US Army and two special topics courses from the Navy. The US Army courses included unit administrative specialist (71L), unit supply specialist (76Y), and one phase of the basic military police (95B). All of the US Army courses were presented in a 2-week block with the following number of hours: 71L - 73 hours, 76Y - 96 hours, and 95B - 66 hours. The Navy courses were handling hazardous waste which was offered three times as a 1-day course and total quality leadership (TQL) which was offered twice as a 1-day course. All of the instructional material was reconfigured for VTT using the 5-component systems approach to training model as developed by US Army TRADOC.

The courseware design was a reflection of the TNET system. The TNET system, due to the video compression rate, had some jerkiness in the video. All motion media, as well as the instructors, had to take this into account and reduce sudden movements. Activities to increase the interactivity of the students were designed into the course. These activities included instructional games, practical exercises, question and answer sessions, and an interactive student guide.

Students in the US Army courses were required to take the standard proficiency tests required for MOS qualification. The tests were unit exams and the students were given one retake if they did not meet the criterion on the first test. Achievement tests were developed for the US Navy courses. Except for the TQL course, students were given pre and posttests. The sample size included 33 in the 71L course, 40 in the 76Y

course, 26 in the 95B course, 116 in the hazardous waste course, and 60 in the TQL course.

On the proficiency tests, 90 percent of the students gained mastery on the first exam and 100 percent gained mastery after the second exam. The students and instructors rated the courses high on effectiveness. The activities to increase interaction were rated as very good or helpful. The project was an overall success, but the authors cautioned that a great deal of time and effort was spent in designing the course for VTT. The VTT course needed more time to develop and more time to administer than the traditional course. In addition, the VTT cost more to produce. However, once developed if used extensively, VTT courses could be more cost effective. The instructors and subject matter experts were also trained for multimedia instruction including how to encourage the interaction of the students.

64. Maslowski, Andy; 1996; Virginia Switches to Compressed Technology; Government Video; 7(3), 40-41.

Describes the SpectrumSaver and tells how the technology works. Due to increased costs for satellite DL, Virginia had switched to digital compression technology, leasing the network to avoid the large conversion costs in a year with no money budgeted for it.

65. Metzko, J., Redding, G. A., and Fletcher, J. D.; 1996; Distance Learning and the Reserve Components; Institute for Defense Analysis; Document D-1941.

Presents the results of a 2-year study of the DL plans of the military services. The main focus of the report was a review of the plans for the military services to provide DL to the reserve community. The authors reviewed 300 studies analyzing DL delivery systems to include: CBT, interactive videodisk, compact disc, and VTT. The findings were:

- DL is as effective as traditional instruction for a wide-range of subjects.
- DL technologies could be used to train the active components of the services as well as department of defense civilians.
- Fiscal savings in travel and per diem as well as reductions in time to train can result from the use of DL.
- Up-front investment costs could be reduced by eliminating duplication across the four services.
- Configuration standards for the four services could increase exchange of courseware.

Also, included in this study were service estimates of the cost per hour to convert traditional training to DL media. The estimates had a wide-

range depending on whether it was done in-house or by contractor and the level of complexity of the course.

66. Miller, John W., McKenna, Michael C., and Ramsey, Pamela; 1993; An Evaluation of Student Content Learning and Affective Perceptions of a Two-way Interactive Video Learning Experience; *Educational Technology*; 33, (6); 51-55.

Examines the content mastery and attitudes of students in both 'live' and 'remote' conditions. The sample consisted of students in two graduate-level education courses. Each course had one session on-campus and one session-off campus. The instructors alternated locations for the origination site of the broadcast so all students participated in both a 'live' and a 'remote' group. The media used for this study was a two-way interactive video system which allowed for both video and audio exchange between the sites. The students were not told in advance about the location change of the professor. The on-campus group, who could have anticipated a live professor for the whole class, felt that their mastery of the material was not as adequate when in the 'remote' mode. The off-campus group perceived no difference in their mastery whether 'live' or 'remote'.

The same result occurred when the students were asked about their perception of classroom interaction with the professor. In the first course the 'live' format mastery of content exceeded the 'remote' format mastery of content, as measured by tests, by more than 15 percent. This was a significant difference in scores. Course 2 exhibited a high mastery of content no matter what the format. The authors of this report in their literature review had found no study that had shown DL to be disadvantageous in terms of mastery of course content. This study represented the only study where DL had been significantly lower than traditional classroom mode in this literature review.

67. Mohan, LTC James C.; 1995; Implementation and Evaluation of a Classroom Multimedia Presentation System; Paper presented at 17th Interservice/Industry Training Systems and Education Conference, Albuquerque, NM.

Discusses upgrading the academic classrooms of the Specialized Undergraduate Pilot Training (SUPT) course for the US Air Force Air Education and Training Command to support multimedia presentations of classroom materials instead of 35mm slide presentations. A detailed analysis was done on the needs and costs of the new system. The decision was made "to purchase a 'turnkey' system that allowed the full integration of digital graphics, images, and video on one screen without the need for manual changes to the video source by the instructor" (p. 3). In addition, they needed a system that would accept graphics and images from multiple sources. The course was volatile and needed constant update, therefore, interactive videodisk systems were eliminated from the

final decision because of the cost to update. Videotape was selected as the video source.

After careful consideration of the available systems and both upfront and sustainment cost, the General Parametrics' VideoShow HQ was chosen as the system. The classes taught with the new method were compared with the old method of 35mm slides. The quantitative measures used for comparison were quizzes and end-of-course exam scores. The qualitative measures were interviews with the students and instructors. The sample size was 58 using the old methods and 65 using the multimedia presentation. The quiz was a 10-item quiz and a t-test was performed on the data. There was no significant difference even though this was the first time the instructors used the new materials. Final course exam scores also yielded no significant difference. In the qualitative portion of the analysis, both the instructors and students deemed the multimedia version of the courseware as effective and pleasant to use. Instructor were pleased with the ease of teaching and mastering the new system. A time savings was also noted on the administrative side of the course because of the reduced handling and more efficient handling of courseware changes.

68. Mood, Terry Ann; 1995; Distance Education An Annotated Bibliography; Libraries Unlimited; Englewood, CO.

Presents a review of the books in the field of DL with an emphasis on teaching and learning. The books that were annotated emphasized the role of the administrator, teacher, and student. The topics covered in this bibliography were the history, the philosophy, management and administration, the teacher, the student, special groups, and the international scene of distance education. Technology was covered as it effects the other topics, but since the technology was changing so rapidly, there was not a review of the literature pertaining to technology. Mood has written a guide for all levels of users. Chapter 3 dealt with planning, setting up, and administering a DL program. Chapter 4 concerned the teacher and covered such topics as roles and responsibilities of the teacher, the type of support that teachers needed, and problems that had been encountered. Student issues were covered in chapter 5 including support systems, library sources, how to predict a successful distant learner, and pitfalls to be avoided by the student, teacher, and institution. Included in the book were two appendices listing some of the journals in distance education and resources for distance education on-line.

69. Moore, Michael G.; 1989; Three Types of Interaction; The American Journal of Distance Education; 3 (2); 1-6.

Discusses the three types of interaction that occur in a learning setting. These were learner-content, learner-instructor, and learner-learner. A

major short fall in DL up to 1989 was the lack of learner-learner interaction. This problem could be alleviated with teleconferencing or e-mail.

70. Moore, Michael G. and Thompson, Melody M. with Quigley, B. Allen, Clark, G. Christopher, and Goff, Gerald G.; 1990; *The Effects of Distance Learning: A Summary of Literature*; The American Center for the Study of Distance Education; University Park, PA.

Presents a review of the literature through 1988 separated into the categories of examples of distance education in the schools, learner achievement, learner perceptions and attitudes, instructor skills, program design considerations, course and curriculum development, use of telecommunications for teacher in-service training, professional developments needs of distance education, cost effectiveness of distance education, and state policies dedicated to distance education. The implications for these categories were also discussed.

The examples of distance education in the schools included correspondence, audioteleconferencing, computer-conferencing, audiographics and a teleconferencing bridge, and video delivered by a variety of systems. Some of the systems used interactive video programs delivered by fiber optics, cable-based systems, satellite transmission, and television programs broadcast by the Public Broadcasting System.

In the learner achievement section, 21 studies on the effectiveness of DL were discussed. The effectiveness of distance education for the studies evaluated was equal to or better than traditional learning, but the authors cautioned that the studies were often incomplete or not generalizable. The studies that focused on adult learning showed no difference in performance for any of the media used to deliver DL as compared to traditional delivery.

Learner perceptions and attitudes favored face-to-face learning but had no effect on performance. The attitudes of the students increased as a result of some personal contact with the instructor, good DL techniques by the instructor, and proper functioning of the equipment.

Instructor skills needed to enhance effectiveness included interaction skills, good summary techniques, techniques to keep the discussions on track, and good oral communication skills. "Any teleconferencing experience was only as effective as its facilitator; for this reason major emphasis should be placed on the appropriate training of instructors who teach via teleconferencing" (p. 17).

The section on program design considerations offered suggestions on management considerations, evaluation, and media selection. The

selection of media should not be hardware driven "based on the assumption that teleconferencing was suitable for the delivery of all educational programming or that one particular technology was suitable for all situations" (p. 20). Audioconferencing was suggested for the discussion of abstract concepts. Audiographics teleconferencing provided both abstract and concrete learning experiences. Video teleconferencing enhanced learner satisfaction. Finally, computer conferencing allowed for convenient transmission of both text and graphics.

The course development section provided the following guidelines. Course development was more time consuming than traditional delivery. Interaction exercises needed to be included in the course. Instructor enthusiasm and effectiveness was improved by participation in the designing of the course.

Several considerations were used to determine cost effectiveness. These considerations included cost of educational telecommunication compared to the cost of traditional delivery, potential savings due to lower travel expenses or the hiring of fewer instructors, and the possibility of increased enrollments. The cost of the programs were generally lower per student than traditional instruction. The authors cautioned that considerable preplanning was needed for an effective program. Included was an annotated bibliography.

71. Mullis, Charles W. and Scholtes, Captain Thomas G.; 1993; Distributed Training Pilot: Voice-Based Language Training Developments Study; TRAC-WSMR-TDS-92-028; US Army TRADOC Analysis Center-White Sands Missile Range.

Presents results of a study conducted to evaluate the impact of CBI utilizing voice recognition technology on the effectiveness of Spanish and French foreign language training. Only the first 10 lessons of the 47 lesson course were converted to CBI. The sample size included 24 in the Spanish experimental group, 44 in the Spanish conventional group, 21 in the French experimental group, and 18 in the French conventional group. The system that was used in the assessment consisted of an IBM-compatible (286) personal computer equipped with a Scott Instruments SIR model 20 speaker-independent speech recognition digital audio board and software subsystem that allows for interaction with a personal computer by speaking and listening. Results were that students performed similarly regardless of the method of instruction, but the students complained that the computer often incorrectly recognized what they said and they were frustrated when this happened.

72. Nutz, Lieutenant Colonel (LTC) Patrick D., Tucker, LTC Michael, and Wilson, LTC Woody; 1995; Breaking the Paper Paradigm: A Revolution in Professional Military Education; Paper presented at 17th Interservice/Industry Training Systems and Education Conference, Albuquerque, NM.

Discusses how the ACSC has transformed the US Air Force concept of professional military education. They have developed a multimedia course with faculty guidance and student labor. There were 600 resident students and about 6000 nonresident students of the course per year. The course was 10 months long. They developed a multimedia course and reconfigured the materials to develop a "problem solving" curriculum. Students were able to access "encyclopedias" of information developed in an interactive mode by students. These encyclopedias included information about the US Navy and the US Army and how they interacted in a joint arena.

Resident students attended a 5 days a week, 10 to 14 hours a day program. Actual time in the seminar room averaged 3 hours per day with the rest of the time devoted to extensive reading, class preparation, and team research. It was in these team research projects that the multimedia modules were built or updated.

Students taking this class at a distance had the full resources of the multimedia CD-ROM and use of the ACSC 'Cyber-Seminar.' The cyber-seminar on-line services were provided by American On-Line and Military City On-Line. During these seminars, instructors or guest speakers guided students through thought provoking discussions. The on-line bulletin board allowed for uploading and downloading the most current information and issues students wanted to share with each other. Students also had real time, on-line access to faculty, subject experts at preset times, and e-mail access at all times. By replacing the text-based delivery system with CD-ROM, production and delivery costs of the course would be reduced by an estimated \$232,000.

73. Patrick, Lieutenant Eric; 1995; Distributed Curriculum Development Environments: Techniques and Tools; Paper presented at 17th Interservice/Industry Training Systems and Education Conference, Albuquerque, NM.

Provides a background for the technology that supports the World-Wide Web and describes how this technology could be used for training. The author proposes a method of training development for the web using existing tools. Any training document that was created by a word processor could be placed on the web. It could be done without changes and as resources became available, it could be enhanced through links to other files to make it more effective. This method was being used to create curriculum for the NROTC. Because of three unique circumstances, the courses could be developed at virtually no cost. These circumstances were:

- All NROTC units were at universities with existing Internet access.

- All units have at least one computer capable of running the software.
- The Chief of Naval Education and Training (CNET) already has a World-Wide Web server established.

An instructor developed a course, put it on the web with limited access for review by other instructors, made corrections and revisions, and then put the course on the web for student access. This method allowed for a wide diversity of courses available to the student with the latest information. Corrections were easily made and the course can be downloaded and stored locally for changes that were area specific. While existing technology and bandwidth limited the amount of video and complicated graphics used in a course, the price of the bandwidth was coming down and full video on demand will be a real possibility in the foreseeable future. This added enhancement will make courses more interactive and improve student performance.

74. Payne, Hank, Manager, Interactive Video Teletraining Program, Federal Aviation Administration; September, 1996; Interview; Federal Aviation Academy; Oklahoma City, OK.

Discusses the FAA use of IVT for DL. The FAA broadcasted its training live and did not have a site facilitator at the training sites. The broadcasts were done from a studio without a class in residence. The rule was that if the training was more cost effective by DL then it was done by DL, otherwise it was done in residence.

When the program was being conceptualized, two types of interaction devices were considered: the OTRS and push-to-talk microphones. While the OTRS was initially more expensive, the transmission costs were considerably lower. With the OTRS, the data lines could be connected to the other FAA data lines so there was no charge for the data transmission. The only time there was a charge for the use of the audio lines was when a student was actually making a comment or asking a question. With the push-to-talk microphones, there was a charge for the audio lines for the entire length of training. To get around this, some agencies only turned on the microphone system during specific question and answer periods, which limited the interaction.

The OTRS allowed the instructor to ask yes-no, true-false, and multiple-choice questions of the students during instruction and also for tests. It allowed the student to push a flag button if he was confused. When the instructor received a certain preset percentage of flags, a red light flashed on the instructor podium and he knew that section of the instruction needed clarification. The student could also push a button to ask a question. When the instructor responded, he was able to identify the student by name and location. The charge for the audio line only began

when the student started talking. An additional feature of the system was that students activated their response system at the beginning of class and after each break by inputting his/her social security number so it also acted as an attendance register.

Conversion costs for the course were kept low by using the instructors to convert the courses with contractor assistance. This assistance was gradually being phased out as the instructors and staff became more proficient. As the courses were being converted, the developers were able to reduce the redundancy and shorten many of the courses. The instructors for the IVT courses received 1 week of training in the additional skills needed to operate the equipment and conduct the class in a manner that encourages interactivity.

75. Payne, Hank; 1996; Video Teletraining Course Conversion Costs: What were They and Can They be Controlled?; Teleconference Magazine; 15 (2); 17-19.

Discusses FAA course conversion costs for VTT. Through the use of VTT the FAA was able to maintain or even increase the quality of instruction while reducing costs. Agencies that had suffered from drawdowns no longer had the talent or manpower to do the conversion work and turned to vendors to provide this service. The cost per hour ranged from \$3,000 to \$12,000 or higher depending on the complexity of the material.

Payne suggested careful selection of the vendor. Some suggestions for selection were to avoid vendors who suggest more costly technology such as CBI, interactive videodisk and video tapes, and select vendors with prior experience in teletraining who provided references of satisfied customers. One way to cut the conversion costs was to do it in-house. Personnel would have to be trained and hone their skills. Contractors could be found who would work with an in-house staff until they were able to do the conversions themselves.

The variable that probably could save the most in course conversion was to have the course in good condition with up-to-date student and instructor guides and good presentation media. The second variable that influenced the costs was to have standards and guidelines developed for the course materials. Without these standards, contractors could spend more than necessary on development. Timely review of draft material and meeting review deadlines also saved money. Simple course conversions that required no update ranged from \$500 (if done in-house) to \$1,500 to \$2,500 (if done by a contractor) per hour of instruction. Complex conversions that required lengthy updates, videotape production, complicated graphics, and did not have VTT course materials standards exceeded \$12,000 per hour. Even though conversion costs were high, the number of students per course significantly impacted the cost effectiveness of VTT.

76. Phelps, Ruth H., Wells, Rosalie A., Ashworth, Robert L. Jr., and Hahn, Heidi A.; 1991; Effectiveness and Costs of Distance Education Using Computer-Mediated Communication; *The American Journal of Distance Education*; 5 (3); 7-19.

CMC compares with traditional training of US Army Reserve officers for both an engineer course and a leadership course. The two methods of teaching the courses were compared for cost and training effectiveness. The course materials were reconfigured for the CMC course but not for the resident course. The resident engineer course was 2 weeks in duration while the same course taken by CMC required 7 months of weekend drills. Student performance for both courses was not significantly different between the two methods. However, the CMC course had a larger attrition rate, especially for the engineer course. While the initial costs were high for course conversion, the CMC version of the course would produce a 43 percent savings after 5 iterations and a 48 percent savings after the 10th iteration.

77. Poole, Howard and Schma, Geraldine; 1995; Statewide Distance Education Networks in Michigan: One Institution's Perspective; *ED Journal*; 9 (4); J-3 - J-11.

Describes four state-wide telecommunications networks in Michigan and their role in education in the state. The characteristics and costs varied for each of the networks, but all of them provided distance education.

The Merit Computer Network (Merit Inc.) provided computer networking and Internet access throughout the state for communication and research purposes.

The Michigan Information Technology Network (MITN) was based on satellite communication and was limited to one-way video and two-way audio. The state of Michigan directed that economic development funds be spent toward the development of a state-wide, satellite delivered engineering program. Four state universities and a number of industrial concerns teamed together to create the MITN. The program had been expanded to deliver all levels of educational programming.

The Michigan Collegiate Telecommunications Association (MiCTA) was originally formed by the larger higher education institutions to save telephone expenses. By owning the phone system, the universities were able to save money as well as improve the system. The purchase of a compressed video bridge by CMU created multipoint connections and made DL more practical. The other universities in the Michigan system could also buy the video bridge and greatly expand this network.

The Michigan Community College Telecommunication Network (MCCTN) was a consortium of the state's community colleges that provided downlink sites in support of DL. The MCCTN also operated one uplink

site and had acquired video compression equipment to expand the network.

Each of the networks had made significant contributions to the DL effort in Michigan and represented the best state-wide options for transmission of a DL class.

78. Preece, Jenny and Keller, Laura; 1991; Teaching the Practitioners: Developing a Distance Learning Postgraduate HCI Course; *Interacting with Computers*; 3 (1); 92-118.

Discusses using DL to teach the postgraduate human-computer interaction (HCI) course. The main audience for this course was engineers already working in industry. Since the students had a wide variety of computer hardware and software, the course developers did not base their course on a particular system. The hands-on portion of the course was an assignment for the students to examine the equipment that they worked on daily, identify a human computer interface problem, and design a solution to fit the problem.

The authors suggested that the same types of questions should be addressed no matter what delivery system was used to deliver the instruction. These questions dealt with "student needs, background, experience, cognitive, and practical constraints" (p. 111). An iterative course development process was used by the authors in which the course was developed in phases. Expert review at the initial phases and student input at the testing phase was recommended to solve problems before the final product was delivered for instruction.

79. Reid, Kim Astrid; 1996; Student Attitudes Toward Distance Learning; Internet; <http://www.att.com/cedl/stdatt.html>.

Discusses student attitudes toward DL. Research data can be grouped into four categories: attitudes toward technology, attitudes toward the teaching method, attitudes toward student-teacher interaction, and attitudes toward being a remote student. The attitude of the student toward the technology improved with familiarization of the equipment and increased reliability of the equipment. The teaching methods used should make the most of the technology available. Interaction with the students versus a 'talking head' improved students attitudes. Either the instructor or a facilitator should be familiar with the equipment and able to handle problems quickly so classtime was not wasted with technological problems. Student-teacher interaction was important to the students. Student attitudes toward DL were linked to the different variables and not to the DL experience itself. These variables should be examined and considered when designing a DL course.

80. Riley, Peter C. and Beebe, Thomas H.; 1995; MultiMedia: A Journey From the Traditional Classrooms of Yesterday to the Presentation Platforms of Tomorrow; Paper presented at 17th Interservice/Industry Training Systems and Education Conference, Albuquerque, NM.

Discusses the evolution of Kirtland Air Force Base MH-53J and MH/HH-60G courses from the traditional classroom settings with 35mm slides and viewgraphs, through the conversion to level I CAI (little more than electronic page turning), and the subsequent conversion to multimedia based instruction. There were lessons learned and a description of the decision process. Conversion to moving pictures expert group (MPEG) video, digitized images, and sound was significantly less expensive than 35mm slides and standard video. The initial costs for compression technology were recouped within the first 2 years of use. Updating the CD-ROMs was accomplished easily and quickly. The advantage of using the CD-ROMs over standard disk was a considerable savings in the packaging and delivering time from 170 to 50 hours and decreased cost from \$4,320 in diskettes per year to \$384 in CD-ROMs. Students and instructors both reviewed the courseware as a positive step forward in instruction.

81. Russell, Thomas L.; 1996; The "No Significant Difference" Phenomenon as reported in 218 Research Reports, Summaries, and Papers; Office of Instructional Telecommunications, North Carolina State University, Raleigh, NC.

Presents a review of 218 research reports, summaries of the literature, and papers dated from 1955 to 1995. The author concluded, "No matter how it was produced, how it was delivered, whether or not it was interactive, low-tech, or high-tech, students learn equally well with each technology and learn as well as their on-campus, face-to-face counterparts." A listing of all sources with relevant quotes make up the bulk of the document.

82. St. Pierre, Suzanne and Olsen, Larry K. 1991; Student Perspectives on the Effectiveness of Correspondence Instruction; *The American Journal of Distance Education*; 5 (3); 65-71.

Discusses measuring student satisfaction with the delivery of college correspondence courses. A survey instrument designed and tested for this research was mailed to correspondence students who had completed college credit courses from Pennsylvania State University. The sample population consisted of 140 males and 197 females. The overall results from the study, supported by statistical analysis, were:

- Student motivation was the single most important variable affecting student satisfaction.

- Student satisfaction and the opportunity to apply experiential learning were directly correlated.
- Prompt return of the graded lessons by the instructor was more important in the beginning than later on in the course.
- One-on-one conversation with the instructor increased the level of satisfaction.
- The relevance of the course content and the helpfulness of the study guide were predictors of students satisfaction with the course material.
- Interaction between the student and the support staff was only minimally predictive of student satisfaction.
- Students who successfully completed one correspondence course were more likely to take another.

The authors suggested that a duplicate study should be done with a different population to replicate the results.

83. Santoro, Gerald M.; 1990; Solving a Problem-Solving Problem via CMC; in Michael G. Moore, Peter Cookson, Joe Donaldson, and B. Allen Quigley, eds; Contemporary Issues in American Distance Education; New York: Pergamon Press; 290-297.

Discusses using CMC to teach a group problem-solving (GPS) course at Pennsylvania State University to improve the effectiveness and efficiency of the course. The CMC version of the course was given in 1987, 1988, and 1989. The average class size was between 175 and 200 students. There were 20 to 24 groups of between 5 to 9 students per group in each class. Two graduate students handled each class. There were videotaped lectures available for the groups and the graduate students could be reached by e-mail.

The results of the outcomes for the classes were that group output was significantly superior to traditional course output; performance on required tests was no different; and students were enthusiastic about the course. Of the very few students who gave the computer course a negative rating, only one attributed it to computer use. The other students attributed it to too much work, problems with other group members, etc. One of the benefits for the CMC version was that while it normally required one professor and two graduate students to teach 60 students, they were now able to teach 175 students. The CMC system used 'generic' e-mail and file transfer systems so it was very cost effective and did not require large hardware expenditures. The GPS course will continue to be taught by CMC at Pennsylvania State University.

84. Schlosser, Charles A.; and Anderson, Mary L.; 1994; Distance Education: Review of the Literature; Washington, DC: Association for Educational Communications and Technology.

Presents a review of a cross section of books, journal articles, dissertations, and conference papers to give a comprehensive overview of the topic of distance education. This book was written for the trainer, media specialist, teacher, graduate student, and professor. Specific topics in the book included:

- A definition.
- The major theories espoused by leaders in the field.
- An overview of the history.
- An overview of current operational issues.
- A selected bibliography of the literature.

Included in the operational issues was a review of the research in distance education separated into the categories of "distance students, their milieu, conditions, and study motivations; and systems of distance education" (p. 17). "Communication and interaction between students and their supporting organizations" (p. 17) was discussed in the context of the previous two topics. The authors cautioned that much of the research falls into two categories: anecdotal and case-study. This type of research was small scale and exploratory and lacks the rigor of "true research." The authors proceeded to give a thorough overview of the research literature that they reviewed. Some insights for the developer of DL programs were available.

85. Sheets, Mary Flanagan; 1992; Characteristics of Adult Education Students and Factors Which Determine Course Completion: A Review; *New Horizons in Adult Education*; 6 (1); 3-20.

Presents a review of the research on participants and persistence in distance education. The research was divided into three sections: descriptive research on distance education students' characteristics; comparison of distance education and conventional students; and studies of student characteristics as they relate to completing distance education courses. Descriptive research on student characteristics revealed what types of people take distance education classes but shed little light on who will be successful. Student success was measured by completion of the course with a passing grade.

The findings comparing distance education students to conventional students yielded some information about participation in each of the programs, the time constraints, and personal preference for distance education; but were not designed to determine a difference in the factors which could ensure success in either program. Personal factors that might help in determining success were studied. Older students had higher completion rates in some studies but not others. The occupational

status of learners had also been found to be insignificant except when the DL impacted the career progression such as nondegree nurses obtaining their registered nursing degree by DL programs. This was also related to motivational factors. Those students who were enrolled for college credit or teacher certification were more likely to succeed. There were no definitive answers for factors that could determine success, but several suggestions for further research were identified.

86. Sherry, Lorraine; 1996; Issues in Distance Learning (in press); International Journal of Distance Education.

Presents a review of literature and current information dealing with the issues in DL. Some of the topics discussed were: redefining the roles of key participants; technology selection and adoption; design issues; strategies to increase interactivity and active learning; learner characteristics; learner support; operational issues; policy and management issues; equity and accessibility; and costs/benefits tradeoffs. The development of a good DL course not only included an assessment of the goals, needs and characteristics of teachers and students but also content requirements and technical constraints.

"Successful distance education systems involve interactivity between teachers and students, between students and the learning environment, and among students themselves, as well as active learning in the classroom" (p. 6). There must be some degree of interactivity in DL. There was some evidence that real time interactivity can raise the retention rate.

The issues raised in this article need more research for definitive answers. The amount of visual imagery to use was just one such issue. "Reliance on exciting visuals may distort the curriculum by focusing the students' attention on the entertaining and provocative features of the presentation rather than encouraging thoughtful analysis of their underlying meaning" (p. 7).

87. Skinner, Michael L.; 1990; The Effects of Computer-Based Instruction on the Achievement of College Students as a Function of Achievement Status and Mode of Presentation; Computers in Human Behavior; Vol 6; 351-360.

Discusses CBI as a function of the achievement level of the students (high, medium, or low), based on previous academic performance, and mode of presentation (solo or guided). In the solo mode of presentation, students were free to complete only those portions of CBI unit tutorials they felt they needed. In the guided mode the students were required to complete all the unit tutorials. The research design was a "single subject" with alternating treatments and frequent measures of performance. The

sample was 36 undergraduate students enrolled in a course in classroom management.

The course was given in personalized instruction mode which consisted of five components: "(1) students progressed through materials at a self-determined pace, (2) a mastery criteria of 70 percent was set for each unit quiz, (3) demonstrations and lectures were presented to extend knowledge mastered via the text and CBI, (4) communication between instructors and students was conducted via a computer bulletin board, and (5) proctors and tutors were available as needed by the students."

There were three instructional conditions for each student: TEXT-CBI-GUIDED, TEXT-CBI-SOLO, and TEXT-ONLY. In the TEXT-CBI-GUIDED condition students read the material in the text, performed the CBI tutorial, answered at least 70 percent of the questions in the tutorial correctly, and took a quiz. In the TEXT-CBI-SOLO condition students read the material in the text, performed those portions of the CBI tutorial that they felt they needed, and took a quiz. In the TEXT-ONLY condition, there were no CBI tutorials to augment the reading.

Except for one unit, CBI conditions produced higher performance levels than text alone on the unit quizzes. This higher performance was maintained on the final exam. Although a human tutor was available for all units, the tutor was consulted for clarification predominately during the TEXT-ONLY condition. There were no consistent differences between CBI-SOLO and CBI-GUIDED since most students treated the conditions the same. There was more benefit from the CBI conditions for the low achiever. The results show that most students will opt to do the CBI tutorials on their own and this increased performance scores over using text alone.

88. Simpson, Henry, Pugh, H. Lauren, and Parchman, Steven W.; 1991; Empirical Comparison of Alternative Video Teletaining Technologies; NPRDC-TR-92-3; Navy Personnel Research and Development Center.

Compares six different VTT technologies and live training. There were seven groups: (1) live taught in the VTT studio, (2) multichannel two-way video with two-way audio, (3) single channel two-way video with two-way audio, (4) one-way video with two-way audio, (5) one-way video with one-way audio, (6) one-way video with intermittent two-way audio, and (7) audiographics. A discussion of the equipment and each of the technologies was included in the report. The remote conditions were simulated within a Navy school house and conditions 5, 6, and 7 were only done on day 2 of the 4-day course.

The class was the Supervisor's Administration and Operations course, which was a maintenance record keeping course. Data were collected

over 6 months with a large number of subjects. The subjects were US Navy active duty and reservist personnel from paygrade of E-1 to O-5. The results indicated that live was significantly better than all VTT. The difference between one-way video and two-way video was statistically significant with one-way video doing better. There was no difference between single-channel two-way video and multiple-channel two-way video and the difference between local and remote classroom was not statistically significant. Good audio seemed to be a primary factor in student satisfaction. Improvements in audio technology were a prime recommendation in the report.

89. Simpson, Henry, Pugh, H. Lauren, and Parchman, Steven W.; 1992; The Use of Videoteletraining to Deliver Hands-on Training: Concept Test and Evaluation; NRPDC-TN-92-14; Navy Personnel Research and Development Center.

Investigates the use of VTT to deliver hands-on training. The course used for this study was the Damage Control Petty Officer course which was a 2-day course with a high student throughput. There were two experiments done. The first compared local to remote instruction, using two-way video and two-way audio, or one-way video and two-way audio. The second compared laboratory strategy either doing a hands-on laboratory or watching videotape of lab procedures without completing a hands-on laboratory.

In experiment 1, there were 215 students evaluated in a two-way analysis of variance using classroom location and VTT technology as independent variables and the final examination as the dependent variable. There were no significant differences found. In experiment 2, a two-way analysis of variance was conducted using type of task and group as independent variables and elapsed time as the dependent variable. There were some statistically significant differences. Students who observed videotapes instead of participating in a laboratory took longer to perform on all performance test tasks and performed less accurately on two out of three. There was some evidence that videotapes were more effective than live demonstrations in helping students learn to perform procedural steps.

90. Smith Roger D.; 1995; Distributed Professional Education and the Internet; Paper presented at 17th Interservice/Industry Training Systems and Education Conference.

Describes a new approach to continued professional education via courses and electronic conferences on the internet. The traditional conference was too costly for the majority of people who needed to attend. The electronic conference could produce the same benefits of training and interaction with other professionals in the field at a substantially reduced cost and time savings. The Electronic Conference on Constructive Training Simulation (ELECSIM) was held in 1994 and hosted by

members of the military simulation community. The conference drew 660 participants from 24 countries. Many factors contributed to the success of the conference, but the biggest one was the ability of people to select and attend the conference without support from their employer.

Asynchronous, electronic messages were used for discussion and enabled even the most quiet members a chance to contribute their input. The electronic conference fees could be paid with digital cash. For example, ELECSIM'95 registration fee could either be mailed or done by voucher via The Network Bank. In addition, the materials of the conference could then be archived via the Internet and accessed as needed. Electronic conferences will not replace traditional forms of training but were one more tool to supplement training to more participants.

91. Sommer, Dr. Hartmut, Wimmel, LTC Albert, and Schultz, Gustav; 1995. Mission Adaptable Learning System for Out of Area Missions; Paper presented at 17th Interservice/Industry Training Systems and Education Conference.

Discusses development of CBT for the German Army to train peacekeeping and peace enforcement missions (or out of area missions, as they were called in the German Army). Besides traditional combat skills, the soldier also needed knowledge of the host country that included cultural customs, conflict parties involved, and environmental concerns. In addition, the training had to be done in a timely manner. Using an extensive database of information related to the various expected contingency operations in combination with CBT, the German Armed Forces had begun to develop a system to train the troops for these types of missions. The system as envisioned would be easy to access and easy to pull those portions of the database into the CBT as needed. The system that has been developed was named Mission Adaptable Learning System (MALS).

92. Sorensen, Christine K.; 1995; Evaluation of Interactive Television Instruction: Assessing Attitudes of Community College Students; DEOSNEWS, 5 (9); 1-7.

Presents a study of community college students' attitudes toward DL via two-way, fully interactive audio and video. The classrooms were all connected on Iowa Communications Network (ICN). Eight of the 15 community colleges in Iowa were conducting summer classes via ICN and were asked to survey their students with a standardized form to measure attitudes toward DL. The survey requested some demographic data, had 25 questions to score on a 4-point Likert scale, and had 2 open ended questions.

The 25 questions were grouped around 5 constructs identified from the literature which were instruction, membership, technical aspects, course management, and course satisfaction. There were a total of 210 students from 22 classes who responded to the survey. Data were analyzed in four

different ways. Frequency data for the 25-items on the survey indicated the level of satisfaction. Overall, mean scores for the constructs were used to measure strengths and weaknesses. T-test comparisons were done to investigate potential differences due to age, gender, student experience, and number of sites involved. Lastly, analysis of open-ended questions provided additional information.

The conclusions drawn from the data were that overall, students seemed satisfied with the DL experience. The negative perceptions were due to technical problems, materials not delivered in a timely manner, sometimes distracting classroom behavior, and 'being on TV' was inhibiting to some. The group comparisons on the constructs revealed that males and older students appeared to feel more involved in the class and males also had a more positive view of the instructor and the learning environment. Comments on the open-ended questions indicated a need for a classroom monitor for remote sites.

93. Souder, William E.; 1993; The Effectiveness of Traditional vs. Satellite Delivery in Three Management of Technology Master's Degree Programs; *The American Journal of Distance Education*; 7 (1); 37 - 53.

Presents the results of a "natural experiment" that was a direct comparison of classroom and DL. The author was contracted to teach the same graduate-level course at three different locations. Two of the three were for a traditional classroom and the other one was for a consortium of universities that deliver instruction by satellite. The course was a semester long. The DL class had 24 students employed at 8 corporations and laboratories in 21 different locations in 18 states. One of the traditional classes was taught in the television studio so there was some interaction between that class and the distance class. The students taking the class watched it live or taped it for later review. If the students watched when broadcast, they could see the instructor and classroom and ask questions during the broadcast.

The study sample consisted of 24 distant students, 13 students in the broadcast studio, and 20 students in a regular university classroom. The distant class scored the highest on the exams which was a significant difference from the class in the broadcast studio but not significantly different from the university classroom. Students from all three classes were satisfied with the experience. The students from the distant class had networked together as a result of a face-to-face meeting at both the beginning and the end of the class. Interaction during the class occurred by electronic transmission and telephone. As a result, the class had bonded together unlike the traditional classes. The quality of the student and motivation were both high for the distance group and may have had an influence on the final outcome.

94. Sparks, Jerry; September, 1996; Interview; CBI Program Manager for the Federal Aviation Administration.

Discusses the CBI program at the FAA. The decision was made early to do all purchasing of hardware centrally. All of the computer systems used for training were exactly the same. The system consisted of a 486 computer running at 33 megahertz with 16 megabytes of random access memory (RAM), digital audio, CD-ROM drive, two 240 megabytes hard drives, 3 1/2" floppy drive, mouse, keyboard, super video graphics adapter, and video overlay; a 17" high resolution color monitor, videodisk player, and speaker with headphones. All the components were commercially available and were covered with a maintenance contract. The central purchase ensured that all the systems were the same and allowed for the best prices because of the amount of the contract. The FAA has 2600 systems available at 1500 sites for instruction. Over 80 courses were offered by CBI in 1996 and the number was growing. All instruction was self-paced. Tests were encrypted and students needed to receive a password from their supervisor to take the tests. Development costs were between \$5,000 to \$10,000 an hour, but the FAA broke even on the cost when 200 to 300 students completed the class. The development costs could be kept low if common templates were developed for format and the contractor only had to concentrate on the content. The author cautioned that very careful contracting had to be done to ensure the quality of the product in the time specified.

95. Stone, Harvey R.; 1990; Economic Development and Technology Transfer: Implications for Video-based Distance Education; in Michael G. Moore, Peter Cookson, Joe Donaldson, and B. Allen Quigley, eds; Contemporary Issues in American Distance Education; New York: Pergamon Press; 231-242.

Discusses the taping of a traditional on-campus class for dissemination to DL students. There were several advantages to this approach, mainly the low cost and the high degree of participation by faculty members. All of the research reviewed by this author involving the comparison of instruction by television and the on-campus class reported no significant differences when comparing similar groups. When a comparison was done between on-campus and video-based off-campus engineering graduate students enrolled in electrical and computing engineering and industrial engineering/operations research, there was no significant difference between degree students on or off-campus. However, there was a significant difference between the degree and nondegree students (not the location). This study involved a sample of 1,028 students over a 5-year period.

Another issue that the author addressed was the benefits of interactive systems versus noninteractive. While interactive programs allowed the

distance student to participate in the class discussion, it limited the distance student to a set time which he must be present to take the class. The noninteractive system allowed the student to take the class at his convenience. Stone reported on a previous study that he had done in which 6378 on-campus and off-campus video-based engineering students from seven colleges of engineering were the study sample. When on-campus students were compared with interactive video-based and noninteractive video-based, there were no significant differences in the three groups. Again nondegree engineering students do worse than degree, no matter what the mode of instruction.

96. Stubbs, S. Todd and Burnham, Byron R.; 1990; An Instrument for Evaluating the Potential Effectiveness of Electronic Distance Education Systems; *The American Journal of Distance Education*; 4 (3); 25 - 37.

Describes a proposed procedure to select the devices for electronic distance education (EDE) systems. This procedure was a PEI to determine a system's potential effectiveness. Five critical dimensions were ranked according to their importance to an EDE system by 19 professionals in the field of education. These dimensions were time/place independence, level of realism possible, communication paths available, ease of use, and speed. Each of these dimensions had a numbered continuum. Through the use of the rankings, each of the dimensions received a weighted value by multiplying the continuum points by the survey's mean ranking. To rate a system's potential effectiveness, the proposed system was matched with the most appropriate description under each continuum. The weighted values were then added together. The authors pointed out that this score was meaningless unless compared to another system. The proposed procedure was intended to be a first step in evaluating which devices to select for EDE. The authors caution to select the level of the dimensions that were appropriate for the type of instruction and not to be lured by high-tech toys.

97. Training and Evaluation Team; AMA-300: FAA Academy; *FAA Distance Learning Demonstration Project: Summary and Lessons Learned*; FAA Academy; 1996.

Discusses six demonstration IVT pilot courses conducted by the FAA during the time period of fiscal year (FY)95 and early FY96. The evaluations indicated that the majority of students rated their IVT experience favorably, met the course objectives, were able to apply and use what they learned on the job, and reported average productivity gains of from \$1,305 to \$6,353 per student. The major lessons learned from all the projects were broken into the following categories: IVT administration, video/audio broadcast, course design, graphics/visual aids, instructors, and OTRS.

The IVT administration lessons learned were that careful planning and coordination with the site administrator should be done to ensure enrollments were complete, that precourse packages were received by the students, and that adequate work time was given to the students to complete the packages.

Video/audio broadcast lessons learned were that each site should have an on-air check prior to the start of instruction early enough to correct any problems so that instruction could start on time and a course of action developed so instruction could continue if technical problems should interrupt instruction.

The course design was crucial to the success of the program. If the course design was bad, the medium rather than the course was perceived as the problem. Other lessons learned about course design were: interactivity could be improved by introducing students at the various sites or providing a class roster; performance could be improved by making the training more active through discussions and group activities; and the OTRS could be used for multiple-choice questions, flagging the classroom, and poll responses. The OTRS could also be used for student-student interaction as well as instructor-student interaction.

Instructor lessons learned included: assign the most highly motivated and enthusiastic instructors for IVT delivery and give them training in IVT techniques. Careful planning, good course development, optimum use of the equipment, and careful selection of the instructors maximized the effectiveness of DL.

98. Twigg, Carol A.; 1994; The Need for a National Learning Infrastructure; Educom Review; September/October 1994; Internet http://educom.edu/educom.review/review94/sept.oct/Twigg_Article.

Compares the traditional college, faculty-centered, learning experience with the student-centered learning experience available with DL systems. Colleges were developed for a relatively homogenous student population and while that population has changed, few colleges have met the challenge of keeping pace with that change. This old way of doing business was called "teaching infrastructure" by the author.

The teaching infrastructure had the following characteristics. Institutions of higher learning exist on the premise that students must travel to an institution to learn. The curricula was based on the abilities and interests of the faculty and not the needs of the students. Student services such as recruitment, counseling, and advising were performed by a staff of student service professionals. These services were performed by this staff to free the faculty rather than to serve the genuine needs of the student. The lecture method used in this infrastructure does not promote

student involvement and active learning. The teaching infrastructure was too expensive and could no longer be a viable option for the majority of the population.

Twigg proposed a national learning infrastructure to supplement the teaching infrastructure that would be based "on collaborative efforts among institutions that scale beyond the local level" (p. 4). The role of faculty would change from teachers to mentors, group project leaders, and designers of instructional experiences. Student-centered curricula would reflect the needs of the students and learning materials would be packaged to reflect the individuals preference of learning style and needs. Instead of the present fixed semester schedule, institutions would operate year round and the student would be able to access learning modules anywhere, anytime, anyplace as needed. To make this transition, the emphasis must shift from instructor teaching to student learning.

99. Weisse, G.S., Petersen, J. and Wimmel, A. H.; 1995; Evaluation of CBT Programs in the German Armed Forces; Paper presented at 17th Interservice/Industry Training Systems and Education Conference.

Presents results of a study to evaluate eight German Army NCO courses taught by CBT. The courses were evaluated on three dimensions: didactic, acceptance, and effectiveness. Over 5000 NCOs were evaluated in a 3-year period. The NCO courses were designed to teach leadership and the objectives of the courses included: counseling, performing military training, finding solutions in social situations, sustaining soldiers in panic situations, handling social group dynamic processes, handling people feeling less preferred, planning successful adult training, and performing as an effective combat team.

The results of the study showed that the students appraised the CBT programs as helpful, supportive, and motivating. Among six factors rated on the acceptance evaluation, the operation of hardware and software as well as the layout and method of the CBT programs were judged best. All of the tested CBT programs produced a positive effect concerning cognitive learning; and after 1 year, not only cognitive effects but even emotional and social effects could be measured. One of the most important findings from the long term study was that practical training can be partially substituted with CBT for these types of courses.

100. Wetzel, C. Douglas, Simpson, Henry, and Seymour, George E.; 1995; The Use of Videoteletraining to Deliver Chief and Leading Petty Officer Navy Leadership Training: Evaluation and Summary; NPRDC-TR-95-8; Navy Personnel Research and Development Center.

Examines the use of VTT for NAVLEAD training which was not instructor centered and demanded high levels of student participation.

This study was done to test the feasibility of using VTT for NAVLEAD training for Leading Petty Officer and Chief Petty Officer training. It also combined results with a previous evaluation of the Division Officer course. There were three different groups: traditional (88 students), VTT local (25 students), and VTT remote (79 students). The groups were compared on five measures which were: student evaluations of VTT, student evaluations on instructional topics, daily observer evaluations on several dimensions of the training, class participation, and student performance on a simulated classroom activity.

When the results were combined with the previous study, the evaluations showed it was generally possible to deliver NAVLEAD training by VTT. Interactivity at remote VTT sites was reduced by about one-third over traditional instruction. However, the two measures reflecting learning during the course were not affected. These evaluations were a first attempt to deliver NAVLEAD instruction by VTT and interaction may improve with efforts by the instructors to develop techniques to increase interaction.

101. Wheeler, Bradley C.; Valacich, Joseph S.; Alavi, Maryam; and Vogel, Doug; 1995; A Framework for Technology-Mediated Interinstitutional Telelearning Relationships; Internet <http://cwis.usc.edu/dept/annenberg/vol1/issue1/wheeler/essay.html>.

Discusses the rewards and pitfalls of two interinstitutional teletraining projects. The goal was to promote more collaborative learning between the two institutions to broaden the viewpoint of the students. The first project was between University of Maryland at College Point (UMCP) and Indiana University (IU). The second project was between UMCP and the University of Arizona (UA). The students and the courses were from the MBA program at all schools.

In the UMCP-IU project, the two institutions used desktop videoconferencing systems for group projects. There were four students on a team, two from each location. The project was a case study from the grocery industry. Due to scheduling conflicts, the course was given after hours. The students were enthusiastic about the project because of the uniqueness and novelty of it. The faculty was pleased with the learning outcome and the visibility it brought to the graduate program. The costs of this system were both the investment in the hardware and the time the faculty used to coordinate and develop the interinstitutional project.

In the UMCP-UA project, two levels of collaborative work were used. The first was synchronous (same time/different place). A graduate MBA elective course taught at both universities was taught in joint class sessions between the two locations by using the high technology teaching theater that both had. The instructors rotated in the teaching role. The second level of the project was asynchronous (different time/different

place). Students from both locations worked on a case analysis for a group project.

Considerable preplanning was needed from both the administrative and the instruction staff to make these projects successful. Clearly defined roles and benefits must be established. The instructors had less instruction time, but the development and administering time was much higher. The higher the activity level between the institutions, the higher the cost in time and equipment. The most important factor for the success of these relationships was the dedication of the champion of the project at each location. A senior faculty member had to be the driving force to get the project funded and administered.

102. Williams, CPT Linda A., Kinney, Patricia A., Ph.D., and Dannhaus, Dale M., Ph.D.; 1992; Distributed Training Pilot: Asynchronous Computer Conferencing (ACC) Training Effectiveness Analysis (TEA); TRAC-WSMR-TEA-91-027; US Army TRADOC Analysis Center-White Sands Missile Range.

Presents results of a study to evaluate using asynchronous computer-conferencing (ACC) to train US Army reserve soldiers on the BNCOC common leader training. The traditional training was done in small groups with 2 instructors for every 12 students. Training occurred 1 weekend a month for 3 months or 1 consecutive 6-day period. There were 4 ACC classes with a total of 68 students and 5 control classes with a total of 58 students. Training effectiveness measures included demographic data, pretest, posttest written exam, supplemental written exam, retention tests, student surveys, and instructor surveys.

The results of the study were that students who received training via ACC scored similarly on two different posttests as students trained in traditional training. A retention test was given 3 to 6 months later and there were no significant differences in the groups after that length of time. Attrition rates were higher for students in the ACC groups than in traditional training. Students responded favorably to both forms of instruction.

103. Winders, Ray; 1988; Information Technology in the Delivery of Distance Education and Training; Soham Ely, Cambridge, England: Peter Francis Publishers.

Presents a series of case studies of successful distance education systems from around the world. A description of the technology employed, the techniques used by instructors, and the students reaction was included for each case study. Although some of the technology discussed had been around for a while, it was still in use. Distance education systems in England, Scotland, US, Australia, Canada, and Israel were represented in the case studies. Also, included were guidelines for setting up and running audioconferencing sessions and videoconferencing sessions. The

last chapter discussed future trends and how new technology might help alleviate the interaction problem between student and instructor.

104. Winkler, John D., Kirin, Stephen J., and Uebersax, John S.; 1992; Linking Future Training Concepts to Army Individual Training Programs; The RAND Corporation; Report R-4228-A.

Suggests an approach for determining the method of training for the Army individual training programs. The three training concepts identified were distributed training (i.e., DL); TADSS; and civilian exchangeability. Based on the assumptions suggested by the literature (p. 8) they concluded that training programs that are predominantly cognitive tasks were appropriate for distributed training and that training programs that were predominantly manipulative were appropriate for TADSS. In addition, any training programs that had tasks that were equivalent to civilian jobs could be exchanged with civilian training.

105. Winkler, John D. And Polich, J. Michael; 1990; Effectiveness of Interactive Videodisk in Army Communications Training; The RAND Corporation; Report R-3848-FMP.

Discusses the use of interactive videodisks (IVD) to supplement or replace hands-on training for some MOS. The IVD portion of the course was 1 week long. Effectiveness was measured by hands-on performance tests. The IVD technology provided increased training opportunities at a lower cost but did not provide the soldier the same feeling of self-confidence that working on the actual equipment did.

106. Witherspoon, John P.; 1996; A "2 +2" Baccalaureate Program Using Interactive Video; DEOSNEWS; 6 (6); 1-9.

Describes the collaborative program that provides students at Coastline Community College with access to a baccalaureate program at California State University, Dominguez Hills, via interactive video technology. The program had been ongoing since fall 1992 with the first five semesters serving as a pilot program. At the conclusion of the pilot program ending in the fall 1994 semester, the two colleges not only continued the program but were expanding it.

The students at the Coastline Community College were working adults, older and had more responsibilities than the typical 18-22 year old college student. Those students at Coastline did consistently better than their university on-campus counterparts for all courses over the five semesters. After four semesters, Coastline graduated their first eight students with baccalaureate degrees. The reasons the students gave for selecting the Coastline program were the easy commute and the need of the course for

academic program. The students estimated taking the classes at Coastline saved them between \$50 - \$300 per course and saved them between 5-10 hours per week. Savings of both time and money were attributed to the savings involved in commuting, baby-sitting, parking, and job-related factors. Although the interactive system was new and there were start up problems and some ongoing problems with the audio system, the students' perception of the program was that the convenience outweighed any of the problems.

Appendix A. Index by First Author

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
Bajtelsmit	1	Contemporary Issues in American Distance Education	Study Methods in Distance Education	1990
Barry	2	The American Journal of Distance Education	A Review of Distance Learning Studies in the US Military	1995
Baehr	3	ED Journal	Interactivity With Response Technology	1996
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Brodie	6	Chesapeake College	Distance Learning Interactive Classroom Faculty Guide	1994
Burge	7	The American Journal of Distance Education	Audioconferencing in Graduate Education	1990
Casey	8	Educational Technology Research and Development	Incorporating Cognitive Apprenticeship in Multimedia	1996
Cheng	9	The American Journal of Distance Education	Comparison of Performance and Attitude in Traditional and Computer Conferencing Classes	1991
Chute	10	Contemporary Issues in American Distance Education	Learning From Teletraining	1990
Cirtin	11	DEOSNEWS	The MBA Degree on Television	1995
Clark	12	Technology Assessment in Education and Training	Assessment of Distance Learning Technology	1994
Cohen	13	17th I/ITSEC Conference	Architectural Analysis of Distributed Multimedia Training Libraries	1995
Coldeway	14	Contemporary Issues in American Distance Education	Methodological Issues in Distance Educational Research	1990

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Cookson	15	Contemporary Issues in American Distance Education	Persistence in Distance Education	1990
Coombs	16	New Horizons in Adult Education	Comparison of Computer and Audioteleconferencing	1989
Cragg	17	Journal of Distance Education	Nurses' Experience of a Distance Course	1991
Curry	18	Management Education and Development	Using Computer Simulations in Management Education	1992
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Dede	23	Learning and Leading in Educational Technology	The Transformation of Distance Education to Distributed Learning	1996
Deloughry	24	The Chronicle of Higher Education	Making Connections	1995
Dereshiwsky	25	ED Journal	Murphy's Law (Mega) Bytes the Dust	1996
Dillon	26	The American Journal of Distance Education	The Study of Distance Education in the US	1992
Dillon	27	Journal of Distance Education	Instructional Strategies and Student Involvement in Distance Education	1991
	28	Federal Training Network	Distance Learning Delivery Systems	1995
	29	Howard University	Distance Learning Directory	1996
	30	University of Michigan	Distance Learning: Planning Considerations and Options	1995
Dwyer	31	Contemporary Issues in American Distance Education	Enhancing the Effectiveness of Distance Education	1990
Eisley	32	DEOSNEWS	Guidelines for Conducting Instructional Discussions on a Computer Conference	1992

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Esteban	33	ED Journal	California State Chico	1996
Fellers	34	Group Decision and Negotiation	Distance Education in the Future	1995
Fetterman	35	ED Journal	Videoconferencing Training	1996
Fletcher	36	Institute for Defense Analysis	Effectiveness and Cost of Interactive Videodisc Instruction	1990
Garg	37	ED Journal	Distance Learning	1996
Garrison	38	The American Journal of Distance Education	An Analysis and Evaluation of Audio Teleconferencing	1990
Golas	39	17th I/ITSEC Conference	The New Media - Interactive 3D	1995
Guckenberger	40	17th I/ITSEC Conference	Integration of Today's Interactive Television and DIS Into Tomorrow's Educational Solutions	1995
Hapeshi	41	International Journal of Human-Computer Interaction	Interactive Multimedia for Instruction	1992
Hansen	42	DEOSNEWS	Teaching Graduate-Level Seminars Using Electronic Mail	1995
Heinlein	43	17th I/ITSEC Conference	Synthetic Environment for Education	1995
Hedegaard	44	ED Journal	Computer-Mediated On-Line Education	1996
Hillman	45	The American Journal of Distance Education	Learner-Interface Interaction in Distance Education	1994
Hiltz	46	International Journal Man-Machine Studies	Correlates of Learning in a Virtual Classroom	1993
Howard	47	TRAC-WSMR	DTP-MOS 75B Distributed Training Course TEA	1992
Howard	48	TRAC-WSMR	DTS TEA MOS 63W Desktop Video Pilot Study	1991
Howard	49	TRAC-WSMR	CAI Study	1994
Hudson	50	SUCCEED	DT-5	1996
Hrydziszko	51	ED Journal	Ford Practices Continuous Improvement in Training	1996
Jinkerson	52	ED Journal	Survey of Distance Learning Students and Teachers	1996

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
Jones	53	FINELINK	Distance Education	1996
Kendall	54	DEOSNEWS	Evaluation of Perceived Teaching Effectiveness	1992
Kulik	55	Computers in Human Behavior	Effectiveness of Computer-Based Instruction	1991
Kulik	56	Technology Assessment in Education and Training	Meta-Analytic Studies of Findings on Computer-Based Instruction	1994
Lehman	57	TRAC-WSMR	VTT-RC TEA	1992
Leonard	58	Journal of Research in Science Teaching	A Comparison of Student Performance	1992
Lewis	59	ED Journal	A Perspective on Distance Learning	1995
	60	Litton-FiberCom	Distance Learning Application	1996
Lovell	61	Teaching and Learning in Medicine	Quantitative and Qualitative Evaluation of Interactive Videodisk	1993
Malloy	62	The American Journal of Distance Education	A Navy Videoteletraining Project	1991
Martin	63	Educational Technology Research and Development	Designing Effective Videoteletraining Instruction	1996
Maslowski	64	Government Video	Virginia Switches to Compressed Technology	1996
Metzko	65	Institute for Defense Analysis	Distance Learning and the Reserve Components	1996
Miller	66	Educational Technology	An Evaluation of Student Content Learning	1993
Mohan	67	17th I/ITSEC Conference	Implementation and Evaluation of a Classroom Multimedia Presentation System	1995
Mood	68	Libraries Unlimited	Distance Education An Annotated Bibliography	1995
Moore	69	The American Journal of Distance Education	Three Types of Interaction	1989
Moore	70	The American Center for the Study of Distance Education	The Effects of Distance Learning	1990

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
Mullis	71	TRAC-WSMR	DTP: Voice-Based Language TDS	1993
Nutz	72	17th I/ITSEC Conference	Breaking the Paper Paradigm	1995
Patrick	73	17th I/ITSEC Conference	Distributed Curriculum Development Environments	1995
Payne	74	FAA	Interview	1996
Payne	75	Teleconference Magazine	Videoteletraining Course Conversion Costs	1996
Phelps	76	The American Journal of Distance Education	Effectiveness and Costs of Distance Education Using CMC	1991
Poole	77	ED Journal	Statewide Distance Education Networks in Michigan	1995
Preece	78	Interacting With Computers	Teaching the Practitioners	1991
Reid	79	CEDL	Student Attitudes Toward Distance Learning	1996
Riley	80	17th I/ITSEC Conference	Multimedia	1995
Russell	81	North Carolina State University	"No Significant Difference"	1996
St. Pierre	82	The American Journal of Distance Education	Student Perspectives on the Effectiveness of Correspondence Instruction	1991
Santoro	83	Contemporary Issues in American Distance Education	Solving a Problem-Solving Problem Via CMC	1990
Schlosser	84	Association for Educational Communications and Technology	Distance Education: Review of the Literature	1994
Sheets	85	New Horizons in Adult Education	Characteristics of Adult Education Students and Factors Which Determine Course Completion	1992
Sherry	86	International Journal of Distance Education	Issues in Distance Learning	1996
Skinner	87	Computers in Human Behavior	The Effects of Computer-Based Instruction	1990
Simpson	88	NPRDC	Empirical Comparison of Alternative Videoteletraining Technologies	1991

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
Simpson	89	NPRDC	The Use of Videoteletraining to Deliver Hands-On Training	1992
Smith	90	17th I/ITSEC Conference	Distributed Professional Education and the Internet	1995
Sommer	91	17th I/ITSEC Conference	Mission Adaptable Learning System for Out of Area Missions	1995
Sorensen	92	DEOSNEWS	Evaluation of Interactive Television Instruction	1995
Souder	93	The American Journal of Distance Education	The Effectiveness of Traditional Versus Satellite Delivery	1993
Sparks	94	FAA	Interview	1996
Stone	95	Contemporary Issues in American Distance Education	Economic Development and Technology Transfer	1990
Stubbs	96	The American Journal of Distance Education	An Instrument for Evaluating the Potential Effectiveness of Electronic DE Systems	1990
Training and Evaluation Team	97	FAA	FAA Distance Learning Demonstration Project	1996
Twigg	98	Educom Review	The Need for a National Learning Infrastructure	1994
Weisse	99	17th I/ITSEC Conference	Evaluation of CBT Programs in the German Armed Forces	1995
Wetzel	100	NPRDC	The Use of Videoteletraining to Deliver Chief and Leading Petty Officer Navy Leadership Training	1995
Wheeler	101	ANNENBERG	A Framework for Technology-Mediated Interinstitutional Telelearning Relationships	1995
Williams	102	TRAC-WSMR	DTP: ACC TEA	1992
Winders	103	Peter Francis Publishers	Information Technology in the Delivery of Distance Education and Training	1988
Winkler	104	RAND	Linking Future Training Concepts to Army Individual Training Programs	1992

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
Winkler	105	RAND	Effectiveness of Interactive Videodisc in Army Communications Training	1990
Witherspoon	106	DEOSNEWS	A "2 +2" Baccalaureate Program Using Interactive Video	1996

Appendix B. Index by Source of Article

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
Cohen	13	17th I/ITSEC Conference	Architectural Analysis of Distributed Multimedia Training Libraries	1995
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Kulik	55	Computers in Human Behavior	Effectiveness of Computer-Based Instruction	1991
Skinner	87	Computers in Human Behavior	The Effects of Computer-Based Instruction	1990
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Santoro	95	Contemporary Issues in American Distance Education	Economic Development and Technology Transfer	1990
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Burge	7	The American Journal of Distance Education	Audioconferencing in Graduate Education	1990
Cheng	9	The American Journal of Distance Education	Comparison of Performance and Attitude in Traditional and Computer Conferencing Classes	1991
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Hillman	45	The American Journal of Distance Education	Learner-Interface Interaction in Distance Education	1994
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Phelps	76	The American Journal of Distance Education	Effectiveness and Costs of Distance Education Using CMC	1991
Souder	93	The American Journal of Distance Education	The Effectiveness of Traditional Versus Satellite Delivery	1993
St. Pierre	82	The American Journal of Distance Education	Student Perspectives on the Effectiveness of Correspondence Instruction	1991
Stubbs	96	The American Journal of Distance Education	An Instrument for Evaluating the Potential Effectiveness of Electronic DE Systems	1990
Deloughry	24	The Chronicle of Higher Education	Making Connections	1995
Howard	47	TRAC-WSMR	DTP-MOS 75B Distributed Training Course TEA	1992
Howard	48	TRAC-WSMR	DTS TEA MOS 63W Desktop Video Pilot Study	1991
Howard	49	TRAC-WSMR	CAI Study	1994
Lehman	57	TRAC-WSMR	VTT-RC TEA	1992
Mullis	71	TRAC-WSMR	DTP: Voice-Based Language TDS	1993
Williams	102	TRAC-WSMR	DTP: ACC TEA	1992
	30	University of Michigan	Distance Learning: Planning Considerations and Options	1995

Appendix C. Index by Subject Matter

Evaluation of Distance Learning

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
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<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
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Lovell	61	Teaching and Learning in Medicine	Quantitative and Qualitative Evaluation of Interactive Videodisk	1993
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Martin	63	Educational Technology Research and Development	Designing Effective Videoteletraining Instruction	1996
Metzko	65	Institute for Defense Analysis	Distance Learning and the Reserve Components	1996
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Simpson	89	NPRDC	The Use of Videoteletraining to Deliver Hands-On Training	1992
Sorensen	92	DEOSNEWS	Evaluation of Interactive Television Instruction	1995

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
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Stone	95	Contemporary Issues in American Distance Education	Economic Development and Technology Transfer	1990
Stubbs	96	The American Journal of Distance Education	An Instrument for Evaluating the Potential Effectiveness of Electronic DE Systems	1990
Training and Evaluation Team	97	FAA	FAA Distance Learning Demonstration Project	1996
Weisse	99	17th I/ITSEC Conference	Evaluation of CBT Programs in the German Armed Forces	1995
Wetzel	100	NPRDC	The Use of Videoteletraining to Deliver Chief and Leading Petty Officer Navy Leadership Training	1995
Williams	102	TRAC-WSMR	DTP: ACC TEA	1992
Winkler	105	RAND	Effectiveness of Interactive Videodisc in Army Communications Training	1990
Witherspoon	106	DEOSNEWS	A "2 +2" Baccalaureate Program Using Interactive Video	1996

Guidelines for Planning and Implementing Distance Learning

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
Brodie	6	Chesapeake College	Distance Learning Interactive Classroom Faculty Guide	1994
Cohen	13	17th I/ITSEC Conference	Architectural Analysis of Distributed Multimedia Training Libraries	1995
Cyrs	19	New Mexico State University	Teleclass Teaching	1990
Davis	21	Contemporary Issues in American Distance Education	Text Comprehension	1990
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Eisley	32	DEOSNEWS	Guidelines for Conducting Instructional Discussions on a Computer Conference	1992
Fetterman	35	ED Journal	Videoconferencing Training	1996
Hapeshi	41	International Journal of Human-Computer Interaction	Interactive Multimedia for Instruction	1992

Computer-Based Training, Computer-Aided Training, and Computer-Mediated Communication

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Cheng	9	The American Journal of Distance Education	Comparison of Performance and Attitude in Traditional and Computer Conferencing Classes	1991
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Eisley	32	DEOSNEWS	Guidelines for Conducting Instructional Discussions on a Computer Conference	1992
Hedegaard	44	ED Journal	Computer-Mediated On-Line Education	1996
Hiltz	46	International Journal Man-Machine Studies	Correlates of Learning in a Virtual Classroom	1993
Howard	47	TRAC-WSMR	DTP-MOS 75B Distributed Training Course TEA	1992
Howard	49	TRAC-WSMR	CAI Study	1994
Kulik	55	Computers in Human Behavior	Effectiveness of Computer-Based Instruction	1991
Kulik	56	Technology Assessment In Education and Training	Meta-Analytic Studies of Findings on Computer-Based Instruction	1994
Metzko	65	Institute for Defense Analysis	Distance Learning and the Reserve Components	1996
Mullis	71	TRAC-WSMR	DTP: Voice-Based Language TDS	1993
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Riley	80	17th I/ITSEC Conference	Multimedia	1995

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
Santoro	83	Contemporary Issues in American Distance Education	Solving a Problem-Solving Problem Via CMC	1990
Skinner	87	Computers in Human Behavior	The Effects of Computer-Based Instruction	1990
Sommer	91	17th I/ITSEC Conference	Mission Adaptable Learning System for Out of Area Missions	1995
Sparks	94	FAA	Interview	1996
Weisse	99	17th I/ITSEC Conference	Evaluation of CBT Programs in the German Armed Forces	1995
Williams	102	TRAC-WSMR	DTP: ACC TEA	1992

Video Teletraining, Video Tapes, and Interactive Videodisk

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
Beare	4	The American Journal of Distance Education	The Comparative Effectiveness in Delivering Teacher Education	1989
Chute	10	Contemporary Issues in American Distance Education	Learning from Teletraining	1990
Cirtin	11	DEOSNEWS	The MBA Degree on Television	1995
Cyrs	19	New Mexico State University	Teleclass Teaching	1990
Dillon	27	Journal of Distance Education	Instructional Strategies and Student Involvement in Distance Education	1991
Esteban	33	ED Journal	California State Chico	1996
Fetterman	35	ED Journal	Videoconferencing Training	1996
Fletcher	36	Institute for Defense Analysis	Effectiveness and Cost of Interactive Videodisc Instruction	1990
Garg	37	ED Journal	Distance Learning	1996
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Hudson	50	SUCCEED	DT-5	1996
Hrydziuszko	51	ED Journal	Ford Practices Continuous Improvement in Training	1996
Jinkerson	52	ED Journal	Survey of Distance Learning Students and Teachers	1996

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
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Kendall	54	DEOSNEWS	Evaluation of Perceived Teaching Effectiveness	1992
Lehman	57	TRAC-WSMR	VTT-RC TEA	1992
Leonard	58	Journal of Research in Science Teaching	A Comparison of Student Performance	1992
Lovell	61	Teaching and Learning in Medicine	Quantitative and Qualitative Evaluation of Interactive Videodisk	1993
Malloy	62	The American Journal of Distance Education	A Navy Videoteletraining Project	1991
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Mohan	67	17th I/ITSEC Conference	Implementation and Evaluation of a Classroom Multimedia Presentation System	1995
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Sorensen	92	DEOSNEWS	Evaluation of Interactive Television Instruction	1995

<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
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Stone	95	Contemporary Issues in American Distance Education	Economic Development and Technology Transfer	1990
Training and Evaluation Team	97	FAA	FAA Distance Learning Demonstration Project	1996
Wetzel	100	NPRDC	The Use of Videoteletraining to Deliver Chief and Leading Petty Officer Navy Leadership Training	1995
Winkler	105	RAND	Effectiveness of Interactive Videodisc in Army Communications Training	1990
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<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
Hansen	42	DEOSNEWS	Teaching Graduate-Level Seminars Using Electronic Mail	1995
Nutz	72	17th I/ITSEC Conference	Breaking the Paper Paradigm	1995
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<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
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Coombs	16	New Horizons in Adult Education	Comparison of Computer and Audioteleconferencing	1989
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Fellers	34	Group Decision and Negotiation	Distance Education in the Future	1995
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<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
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Cookson	15	Contemporary Issues in American Distance Education	Persistence in Distance Education	1990
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<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
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<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
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Wheeler	101	ANNENBERG	A Framework for Technology-Mediated Interinstitutional Telelearning Relationships	1995
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<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
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Deloughry	24	The Chronicle of Higher Education	Making Connections	1995
	30	University of Michigan	Distance Learning: Planning Considerations and Options	1995
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Payne	75	Teleconference Magazine	Videoteletraining Course Conversion Costs	1996

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Phelps	76	The American Journal of Distance Education	Effectiveness and Costs of Distance Education Using CMC	1991
Riley	80	17th I/ITSEC Conference	Multimedia	1995
Sparks	94	FAA	Interview	1996

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<u>Author</u>	<u>Ref #</u>	<u>Source</u>	<u>Short Title</u>	<u>Date</u>
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Acronyms

3D three dimension

A

AAIS	audio-assisted independent study
AC	audioconferencing
ACC	asynchronous computer-conferencing
ACSC	Air Command and Staff College
AIT	advanced individual training
ARPA	Advanced Research Project Agency
AT&T	American Telephone and Telegraph
ATM	asynonomous transfer mode

B

BNCOC Basic Noncommissioned Officer's Course

C

CAI	Computer-Assisted Instruction
CAM	cell adaptation multiplexer
CAT	computer-aided training
CATV	cable authorized television
CBI	computer-based instruction
CBT	computer-based training
CD-ROM	compact disk-read only memory
CGSC	Command and General Staff College
CHM	College of Human Medicine
CLU	chartered life underwriter
CMC	computer-mediated communication
CMU	Carnegie Mellon University
CNET	Chief of Naval Education and Training
COM	College of Osteopathic Medicine
COMET	cooperative program for operational meteorology education and training
CPT	captain
CSU	California State University

D

DCST	Deputy Chief of Staff for Training
DGSS	distributed group support systems
DL	distance learning
DT-5	deliverable team #5
DTIC	Defense Technical Information Center

E

EDE	electronic distance education
ELECSIM	Electronic Conference on Constructive Training Simulation
ERIC	Educational Resources Information Center

F

FAA	Federal Aviation Administration
FTP	file transfer protocol
FY	fiscal year

G

GPS	group problem-solving
GSS	group support systems

H

HCI	human computer interaction
HP	Hewlett-Packard
HTML	hyper text markup language
HTTP	hyper text transfer protocol

I

ICN	Iowa Communications Network
ICW	interactive courseware
ISDN	Integrated Services Digital Network
IU	Indiana University
IVD	interactive videodisk
IVI	interactive videodisk instruction
IVT	interactive video teletraining

J

JITL	just-in-time lecture
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L

LTC	lieutenant colonel
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M

MALS	Mission Adaptable Learning System
MBA	master of business administration
MCC	movement control center
MCCTN	Michigan Community College Telecommunications Network
MiCTA	Michigan Collegiate Telecommunications Association
MITN	Michigan Information Technology Network
MOS	military occupational specialty
MPEG	moving pictures experts group

N

NASA	National Aeronautics and Space Administration
NAVLEAD	Navy leadership
NCA&T	North Carolina Agriculture and Technical
NCO	Noncommissioned Officer
NCSU	North Carolina State University
NII	national information infrastructure
NROTC	Navy Reserve Officer Training Corps
NTC	National Teletraining Center

O

OCONUS outside the Continental United States
OTRS One Touch Response System

P

PC personal computer
PEI potential effectiveness inventory

R

RAM Random Access Memory
RISC reduced instruction set computer

S

SAT scholastic aptitude test
SEE synthetic environment for education
SIMATAR Simulation in Training for Advanced Readiness
SUPT specialized undergraduate pilot training

T

TADSS Training Aids, Devices, Simulators, and Simulations
TEA Training Effectiveness Analysis
TIS televised instruction system
TNET teletraining network
TQL total quality leadership
TRAC-WSMR TRADOC Analysis Center-White Sands Missile Range
TRADOC Training and Doctrine Command

U

UA University of Arizona
UMCP University of Maryland at College Park
US United States

V

VAIS video-assisted independent study
VC virtual classroom
VOC video on campus
VTT video teletraining
VTT-RC Video Teletraining - Reserve Component

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Naval Amphibious Base Little Creek
Norfolk, VA 23521-5249 2

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Redstone Arsenal, AL 35897-6000 2

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Commandant US Army Command and General Staff College ATTN: ATZL-SWO-FD 1 Reynolds Avenue Fort Leavenworth, KS 66027-1352	2
Commandant Defense Language Institute Foreign Language Center ATTN: ATFL-OPP-PO Presidio of Monterey, CA 93944-5006	2
Commandant US Army Signal School ATTN: ATZH Fort Gordon, GA 30905-5000	2
Commandant US Army Chemical School ATTN: ATZN-CM Fort McClellan, AL 36205-5020	2
Commandant US Army Military Police School ATTN: ATZN-MP Fort McClellan, AL 36205-5030	2

Commandant US Army Logistics Management College ATTN: ATSZ-A 2401 Quarters Road Fort Lee, VA 23801-1705	2
Commandant US Army Warrant Officer Career Center ATTN: GSB Building 5302 Fort Rucker, AL 36362-5000	2
Commandant Army Management Staff College 5500 21st Street, Suite 1206 Fort Belvoir, VA 22060-5934	2
Commandant Air Base Ground Defense School Fort Dix, NJ 08640	2
Commandant Recruiting and Retention School Fort Jackson, SC 29207-5000	1
Chief Army Reserve 2400 Army Pentagon Washington, DC 20310-2400	1
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